An Evaluation of Autism Spectrum Disorder Traits and the Social and Emotional Cognition of Adolescents with Anorexia Nervosa

Shane Mulligan

118224907

Doctor of Clinical Psychology

School of Applied Psychology

University College Cork

Supervisors; Dr Christian Ryan & Dr Aoife Dáibhis

This is to certify that the work I am submitting is my own and has not been submitted for another degree, either at University College Cork or elsewhere. All external references and sources are clearly acknowledged and identified within the contents. I have read and understood the regulations of University College Cork concerning plagiarism.

Acknowledgements

First and foremost, I would like to sincerely thank my supervisor Dr Christian Ryan who has been such a fantastic academic mentor. His approachability, experience, knowledge, patience and encouragement has helped me immensely throughout the project. This help has made this project such a fantastic learning experience for which I am very grateful.

I would also like to extend my gratitude to the specialist eating disorder services that supported the research and for the valuable input from clinicians, particularly Dr Aoife Dáibhis for her guidance and encouragement from the beginning. I am also grateful to parents of participants for allowing their children and young people to participate. Thank you to participants themselves who gave generously of their time to participate in the research.

Thank you to my parents for all the encouragement and support over the last number of years. I am incredibly grateful for all both of you have done for me. Thank you also to Darragh, Alana, Rosemary and Hannah for all your support.

Thank you also to the faculty of the UCC School of Applied Psychology. I have relished the opportunity to train and really enjoyed my time here where I have learned so much. I am also grateful to the various placement supervisors I have had over the course of clinical training. The knowledge and experience gained through these placements greatly supported the completion of this project.

I would also like to thank my friends and colleagues on the clinical programme. It has been a pleasure working with such a supportive and encouraging group of people.

Lastly, thank you to everyone who has been a part of the journey over the last three years and made it such a memorable experience.

Table of Contents

Overview of Thesis

The purpose of the present dissertation is to investigate Autism Spectrum Disorder (ASD) traits and aspects social and emotional functioning consistent with ASD among young people with Anorexia Nervosa (AN). This dissertation is made up of four sections;

(1) Literature review

The literature review will consider the aetiology of AN and ASD, their clinical presentation, overlap between the disorders and the theories underlying the aetiology of both conditions. Literature relating specifically to ASD and associated traits with respect to social and emotional functioning in AN will be examined. This will be followed by the theoretical positions proposed to explain the presence of traits consistent with ASD in AN which frame the research questions.

(2) Systematic review and meta-analysis

Title: Using the Autism-Spectrum Quotient to Measure Autistic Traits in Adolescents and Young People with Anorexia Nervosa: A Systematic Review and Meta-Analysis

The principal focus of the systematic review and meta-analysis is to understand the prevalence of ASD traits as measured by one of the most commonly used screening measures of Autism traits in AN, the Autism Quotient (AQ) and AQ short version, the AQ10. The systematic review and meta-analysis was limited to studies conducted with adolescents and young people under the age of 25 with AN to assess the prevalence of ASD traits prior to prolonged periods of nutritional deprivation. This is presented through a specific journal article format.

(3) Empirical research written in specific journal article format

Title: An Evaluation of Autism Spectrum Disorder Traits and the Social and Emotional Cognition of Adolescents with Anorexia Nervosa

The empirical research is presented in two parts, the first of which is in a journal article form tailored to the format of a specific academic journal. This incorporates the most relevant aspects of the literature review in addition to the methodology, results and discussion of the present empirical research study. The second part presents the empirical research through a supplementary methodology, results and discussion section which follow sequentially from the literature review (Section 4).

The original empirical research section of the dissertation seeks to investigate traits consistent with ASD and related aspects of social and emotional cognition among young people with AN. ASD is proposed to exist on a spectrum where more pronounced ASD traits are often associated with functional impairment in social functioning, language, communication and restricted/repetitive interests. At the less pronounced end of the spectrum ASD traits are considered more subtle and not generally associated with functional impairment. Research with AN groups has indicated that a considerable percentage of these research samples meet the criteria for ASD. Prior research has also indicated that among those individuals with AN not meeting the full criteria for an ASD diagnosis commonly have increased levels of ASD traits as compared to control populations.

The purpose of the present research is to understanding if commonly reported ASD traits and difficulties with social and emotional cognition with ASD are present in the early stages of AN prior to prolonged nutritional deprivation. Within previous literature, traits associated with ASD have been studied individually among groups with AN. This study is the first to examine ASD traits, theory of mind, alexithymia and empathy simultaneously in an adolescent group with AN.

The study assumes a cross-sectional design where participants consist of two adolescent groups; individuals with AN attending a specialist eating disorder service and a healthy control

group recruited from the community through secondary schools. The study collected participant demographic, clinical symptoms and illness-related variables in addition to self-reported ASD traits, a theory of mind task, and measures of alexithymia and empathy.

Data were analysed by comparing group means across dependent variables. AN group-specific analyses were conducted using correlational analyses to examine relationships between dependant variables. Findings are presented in the context of prior literature.

(4) Empirical research study supplementary chapters

The supplementary chapters present the empirical research through supplementary methodology, results and discussion sections.

Section One: Literature Review

Literature Review

The purpose of this literature review is to investigate traits associated with Autism Spectrum Disorder (ASD) related social and emotional functioning difficulties among young people with Anorexia Nervosa (AN). Prior to exploring this in more detail it is pertinent to consider the aetiology of AN and ASD and the theoretical explanations that have been proposed for both conditions.

Anorexia Nervosa

Anorexia nervosa (AN) is a severe and potentially life-threatening eating disorder. It is characterised by an intense fear of weight gain and disturbed body image which motivates severe dietary restriction and other weight loss behaviours. There are two subtypes of AN; the restricting subtype (AN-R) which is characterised through significant weight loss achieved through dieting, fasting, and/or excessive exercise. The binge-eating/purging subtype is typified through recurrent episodes of binge eating or purging behaviour (APA, 2013). People with AN generally present with low body weight as measured through body mass index (BMI) or percentage weight for height (%WFH), where the latter is commonly used for patients under eighteen. However, Atypical AN (ATAN) is a diagnosis within the "Other Specified Feeding or Eating Disorder" category which is the exception. A diagnosis of ATAN is applied when all criteria for AN are met except significant weight loss, or if the individual has had significant weight loss resulting in malnourishment, but their weight remains within ranges considered normal (Moskowitz & Weiselberg, 2017). AN can develop among individuals of all ages, sexes and ethnicities; however, the onset typically occurs among adolescent and young adult females, onset over 30 or among males is less common (Treasure et al., 2020; Volpe et al., 2016). The lifetime prevalence of AN in developed countries is reported to be 1% in women and less than 0·5% in men (Smink et al., 2012).

Autism Spectrum Disorder

Unlike AN, ASD is a complex lifelong neurodevelopmental condition commonly characterised by difficulties in social communication, atypical cognition, sensory sensitivities and restricted and repetitive patterns of behaviour (APA, 2013; Lai et al., 2013). ASD presents more frequently in males, with reported gender ratios ranging from 2:1-5:1 and a prevalence rate of one in every 132 persons (Baxter et al., 2015; Lord et al., 2020). ASD is not homogeneous in its presentation. Accordingly, the concept of a continuum or spectrum is used to explain variations in presentations. At the less pronounced end of the spectrum where difficulties in social functioning, language, communication and restricted/repetitive interests are more subtle, these represent less overt ASD traits. These traits may not result in any functional impairment, but collectively these traits may represent a specific ASD related profile. Although not a diagnostic category, the Broader Autism Phenotype (BAP) is proposed to represent a subgroup of individuals who experience sub-clinical impairments similar to those shown by individuals with ASD. (Gerdts & Bernier, 2011). This phenotype represents traits associated with ASD but do not meet the diagnostic threshold (Piven & Benjamin, 2002). At the more pronounced end of the autistic spectrum, individuals who demonstrate clinically significant impairments in social functioning, language, communication and restricted/repetitive interests as examined through developmental and observational assessments generally receive a diagnosis of ASD (APA, 2013).

Despite males with ASD considerably out representing females with the condition, females with ASD still represent a substantial group and may present differently to their male counterparts. It has been proposed that although females with ASD have the same underlying traits as their male counterparts, the behavioural expression of these characteristics may differ (Hull et al., 2020). For example, females with ASD are reported to be more socially motivated, adept at "camouflaging" social and communication difficulties; restricted interests and

repetitive behaviours are also reported to be less apparent or age and gender-typical (Allely, 2019; Hull et al., 2020; Lai et al., 2017). Through presenting with less obvious ASD behaviour and traits, it is proposed that this may result in missed diagnoses among females with ASD (Begeer et al., 2013; Loomes et al., 2017).

Overlap in Presentations

Although there are significant differences in the main diagnostic criteria and typical profile of individuals with AN and ASD, increasingly research has suggested similarities and comorbidities among individuals with these conditions (Courty et al., 2013). Individuals with ASD often present with restricted and rigid eating behaviours. In some instances, this can present as neophobia or Avoidant-Restrictive Food Intake Disorder (ARFID; APA, 2013; Sharp et al., 2018). Restricted and rigid eating behaviours are core features of AN (Fairburn, 2008). Individuals with ASD commonly display cognitive and behavioural rigidity, a preference for sameness, intense and restricted interests. Within AN, this can present as clinical levels of perfectionism, a preoccupation and rigidity around calories, eating routines, and losing weight (Kinnaird & Tchanturia, 2021). Although typically more pronounced in ASD, peer and relationship difficulties are common to both conditions (Cresswell et al., 2019; Rhind et al., 2014; Westwood et al., 2016), as are atypical sensory profiles (Ben-Sasson et al. 2009; Brand-Gothelf et al., 2016). Further to this, similarities in cognitive functioning such as poorer performance in set-shifting and central coherence tasks have been observed in both AN and ASD (Sampaio et al., 2013; Westwood et al., 2016). This suggests that a similar cognitive profile may underlie both disorders. Difficulties in social and emotional processing are common in both AN and ASD and elaborated in further detail later.

Although there are similarities between presentations, there are also some notable differences. Among ASD populations, levels of cognitive functioning vary widely, where ASD often co-occurs with intellectual disability (Autism and Developmental Disabilities Network, 2020;

Charman et al., 2011). In contrast, people with AN generally perform well academically and have been reported to score within or above the average intelligence quotient of the normative population (Lopez et al., 2010; Stedal et al., 2012).

Aetiology of AN and ASD

The aetiology of both disorders is not fully understood; both have been associated with multiple causes, genetic, epigenetic and environmental in nature. ASD is reported to have a sizeable heritable component where hundreds of genes have been associated with the condition. Genetic risk factors are highly variable, potentially reflecting heterogeneity across diagnostic presentations, the subthreshold BAP and less overt traits within the general population (Vorstman et al., 2017). The genetic heritability of the disorder is evidenced through research that has reported increased difficulties associated with ASD in the parents (Rubenstein & Chawla, 2018), and siblings of children with ASD (Pisula & Ziegart-Sadowska, 2015).

Additional factors associated with ASD include advanced maternal and paternal age, toxic chemical exposure in the environment, maternal diabetes and maternal treatment with selective serotonin reuptake inhibitors (Bölte et al., 2019). Foetal exposure to sex steroids is also proposed to have implications for prenatal brain development which may result in ASD. These factors considered, no definitive explanation for its development has been identified.

For AN genetic influences have been proposed to account for the reported heritability of the illness in families. AN or subthreshold eating disorders in first-degree relatives of people with AN are reported to range between 3%-12% (Thornton et al., 2011), with twin-based heritability estimates ranging from 50-60% (Yilmaz et al., 2015). Genome-wide association studies have also identified candidate genes and sequences associated with AN. AN has shown significant genetic correlations with specific personality traits such as neuroticism and psychiatric conditions, including obsessive-compulsive disorder, depression, and anxiety. Specific

metabolic traits such as insulin sensitivity, growth, lipids and size have also been identified as having genetic associations to AN (Watson et al., 2019).

When considering epigenetic factors, it is proposed that exposure to environments that place emphasis on weight or thinness may lead to the overexpression of genes that suppress appetite and/or weight in individuals who may potentially be vulnerable to AN (Yilmaz et al., 2015). Additional environmental factors associated with AN include parents modelling dieting, parental emphasis on child weight, familial dysfunction, weight-related teasing and sport-related motivations (Chen & Couturier, 2019; Mazzeo & Bulik, 2010; Tozzi et al., 2003). Developmental factors such as adverse prenatal or neonatal events, feeding and sleeping difficulties in infancy have been associated with AN. The disorder may often be precipitated by stressful life transitions (Zipfel et al., 2015). Personal characteristics, including perfectionism, negative self-evaluation, low novelty seeking and high harm avoidance, have all also been associated with AN (Amianto et al., 2011; Dahlenburg et al., 2019; Fairburn et al., 1999). Although sociocultural factors promoting a thin ideal have also been posited as a risk factor, the impact of these pressures in the development of AN has not been confirmed with the disorder also being diagnosed in non-industrialised societies (Moskowitz & Weiselberg, 2017).

Theoretical Explanation of ASD

Although no definitive theoretical explanation of ASD, one of the most prominent theories proposed to explain ASD and its associated characteristics is "The Extreme Male Brain Theory" (Baron-Cohen, 2002). Prior to describing The Extreme Male Brain Theory of ASD, it is useful to consider the Empathising–Systemising Theory of typical sex differences implicated in the theoretical explanation of ASD (Baron-Cohen, 2009). This theory proposes that people can be classified on the basis of two dimensions: (1) empathy, the capacity to recognise and respond appropriately to another person's thoughts and feelings, and (2) systemising, defined

as the drive to analyse or construct rule-based systems. Baron-Cohen (2009) contends that differences between empathising and systemising as measured by standardised measures can be converted into five "brain types" that explain differences in gender and difficulties among people with ASD. Where empathising and systemising are considered equal, this is a "balanced" or Type B brain. Where empathising scores are higher than systemising, this is Type E. Where systemising scores are higher relative to empathising, this is Type S. Where empathising scores are considerably higher than systemising, this is deemed to be Extreme Type E. When systemising scores are considerably higher than empathy, this represents an Extreme Type S profile.

Analysis of these "brain types" derived from these measures has indicated that females on average were more likely to be Type E or Extreme Type E demonstrating a propensity and capacity for empathising. Males, on average were more likely to be Type S or Extreme Type S, which is associated with a disposition or aptitude towards closed or rule-based systems.

The Extreme Male Brain theory proposes that people with ASD or traits consistent with the BAP are more likely to have a Type S or Extreme Type S regardless of gender. This theory stemmed from research considering foetal exposure to sex steroids where the "Extreme Male Brain" is one where there has been overexposure to the prenatal steroids resulting in systemising processes being hyper-developed relative to empathising. Prior to oestrogenic hormones being identified as potentially having a role in ASD (Baron-Cohen et al., 2020), early observations of more systematised behaviour led to Baron-Cohen et al. (2011) to hypothesise that prenatal exposure to testosterone may result in this "Extreme Male Brain" which represented ASD. The "Extreme Male Brain" is proposed to account for ASD and associated traits such as difficulty identifying the emotions or perspectives of others, a preference for rule-based information or closed systems, attention to detail, as well as an enhanced capability for scientific or rule-based subjects (Baron-Cohen, 2002; Billington et al., 2007).

Theoretical Explanation of AN

There is no definitive theoretical explanation of AN (Treasure et al., 2020). As mentioned previously, past research has described numerous aetiological risk factors such as genetics (Watson et al., 2019), exposure to environments that place emphasis on weight or thinness (Yilmaz et al., 2015) and life adversity (Zipfel et al., 2015). The most comprehensive theoretical explanation of AN which incorporates these factors is the Cognitive-Interpersonal Maintenance Model of AN (Schmidt & Treasure, 2006). This model which has been outlined through a series of articles and builds upon previous explanatory frameworks of AN and incorporates biological, psychological and environmental risk factors associated with the onset and maintenance of the disorder.

In their initial paper, Schmidt and Treasure (2006) build upon the cognitive and behavioural explanation for the onset of the disorder (Fairburn, 2008). This posits that an overvaluation of weight resulting from early environmental experiences (i.e. parental emphasis on body shape or appearance) leads to initial dieting where weight loss is desired and once achieved results in positive affect. Positive affect associated with weight loss or external validation generally results in further weight loss behaviours. As dieting progresses, people with AN develop rules or standards with regard to what appropriate intake which typically results in a calorie deficit and weight loss. This is generally accompanied by perfectionist personal standards where no level of weight loss is considered adequate. This results in the pattern of weight loss continuing and ultimately resulting in starvation.

Eating in this starved state results in unpleasant physical sensations which perpetuates erroneous beliefs about what is considered appropriate intake. Starvation has also been proposed to result in an all-encompassing focus on food which can act as a distraction. Some people with AN are also reported to experience an emotional "numbing" which may be valued. The model contends that these behaviours are driven and maintained by personal factors such

as perfectionism, difficulties tolerating distress, pro-AN beliefs and cognitive rigidity (Fairburn, 2008).

Schmidt and Treasure (2006) also propose that interpersonal reactions play a role in the onset and maintenance of the disorder. For example, initial weight loss may be complemented by peers or family and inadvertently positively reinforce weight loss. When the disorder is more developed, this can elicit care and concerned attention for the person where it may not have been present previously, this care may also result in further pro-AN beliefs. Alternately, this concern can result in negative or critical responses from family members, particularly where there is frustration surrounding the person not acknowledging the illness or accepting help. Due to difficulties tolerating distress, this can result in the person isolating themselves from others and placing a further value on their illness as a coping mechanism. These personal and interpersonal patterns typically perpetuate with increased severity in the absence of intervention.

Through the second iteration of the model, Treasure and Schmidt (2013) posit that certain traits lead to an increased vulnerability to AN and also contribute to the maintenance of the disorder. These traits pertain to cognitive, social and emotional functioning within the AN literature, such as difficulties with set-shifting, weak central coherence, interpretation of social signals and understanding the perspectives of others. Although the authors contend that these traits are obsessive-compulsive traits, these may be more appropriately categorised as sub-threshold ASD traits. They propose that these difficulties act as vulnerability factors that predate illness onset and become exacerbated with illness duration due to the secondary consequences of malnutrition. This is proposed to result in more pronounced difficulties in cognitive, social and emotional functioning, further compounding the illness.

In the most recent Cognitive-Interpersonal Maintenance Model of AN article, the authors elaborate further upon perpetuating aspects of AN such as chronic stress, anxiety, depression, social isolation and familial or professional burnout that typically occur throughout the severe and enduring stage of the illness (Treasure et al., 2020). Within this iteration of the Cognitive-Interpersonal Maintenance Model, the focus on obsessive-compulsive traits is reduced. This was in addition to the potential impact ASD traits may have on the illness being recognised. The Cognitive-Interpersonal Maintenance Model of AN throughout its updates has been supported by accumulating empirical evidence and serves as a useful framework for conceptualising AN. It has also demonstrated its relevance to clinical practice by forming the basis for one of the foremost treatment approaches, the Maudsley Model of Anorexia Treatment for Adults.

Prevalence of ASD in AN and Associated Traits

ASD Diagnosis

Similarities in presentations have prompted researchers to examine the prevalence of ASD in AN. ASD diagnosis is complex, and best practice dictates that observational and developmental assessments should both be completed (NICE, 2017). The Autism Diagnostic Observation Schedule 2nd Edition (ADOS-2) is a standardised ASD observational assessment tool. Studies using the ADOS-2 have reported that many individuals with AN meet the suggested clinical cut-off on the measure; however, the percentage of participants meeting this threshold across studies is variable. Postorino et al. (2017) reported that 10% of their sample of 30 adolescents with AN met the threshold that indicated the presence of ASD on the ADOS-2, Westwood et al. (2017) also reported that 23.3% of their sample of 60 adult women scored above this threshold on the same measure. Although indicative of ASD traits among AN cohorts, this does not equate to diagnosis due to an absence of a developmental assessment considering ASD traits in childhood.

In the largest study to include both observational and developmental assessments conducted by Westwood et al. (2018), 52.5% of their sample of adolescent females met the threshold on the ADOS-2. However, only 10% scored above the cut-off for both once the developmental assessment was incorporated. This indicates that ASD traits may not have been present or were less evident growing up for participants. The authors propose that the disparity between the observational measure and the developmental measure may be accounted for due to ASD diagnostic measures not being sensitive to female ASD presentations. They also suggest that an ASD presentation may be associated with the nutritional deprivation associated with AN.

Further evidence for this is provided by Sedgewick et al. (2019) where they examined differences in the ADOS-2 scores among women with AN, individuals recovered from AN and healthy controls. Findings indicated that more individuals in the AN group and recovered individuals scored above the ASD diagnostic cut-off compared to healthy controls. Interestingly, recovered individuals represented a midpoint between the scores of those with and without AN, thus potentially indicating an acute ill state-related impact on ASD presentation. A similar trend was reported by Kerr-Gaffney et al. (2020), where an acute AN group performed more poorly than the recovered cohort on the ADOS-2. These findings suggest that ASD traits as measured by observational measures may be impacted by the acute state of nutritional deprivation associated with the illness.

ASD Traits in AN

As mentioned previously, ASD is heterogeneous and the concept of a spectrum is used to explain variations in presentation (Gerdts & Bernier, 2011). Individuals with AN not meeting the full criteria for an ASD diagnosis commonly have increased levels of ASD traits as compared to control populations (Sedgewick et al., 2019). This has led researchers to examine the presence of ASD traits in AN. One of the foremost measures for screening for ASD traits is the Autism Quotient (AQ) (Baron-Cohen et al., 2001). It is a self-report screening instrument

commonly used in research assessing ASD traits among the general population and other psychiatric diagnoses (Cath et al., 2008; Wouters & Spekb, 2011).

The AQ has been commonly utilised to measure ASD traits among AN research participants. This is to the extent that it allowed Westwood et al. (2016) to conduct a systematic review and meta-analysis of studies comparing profiles of AN cohorts to healthy control groups on the AQ. Meta-analyses were conducted for the entire sample, in addition to specific analyses for adults and children/adolescents respectively. The overall analysis indicated a large effect size between AN and healthy control groups on the AQ with the AN group scoring more highly, thus indicating higher ASD traits. Analyses conducted on subscales indicated that AN groups reported more difficulties on four out of the five sub-scales; social skills, attention switching, communication and imagination. In the child/adolescent specific meta-analysis, Westwood et al. (2016) compared 90 children/adolescents with AN to a healthy control sample of 625. These results indicated significantly more ASD traits among the AN group with a large effect size.

Further to the AQ, the Social Responsiveness Scale 2nd edition (SRS-2) is another ASD screening instrument measuring social cognition, social awareness, social communication, social motivation and restricted interests and behaviours (Constantino & Gruber, 2012). Kerr-Gaffney et al. (2020) utilised the self-report SRS-2 when assessing ASD traits through a cross-sectional design with individuals with AN, a recovered AN group and a healthy comparison group. Results indicated that the acute AN and recovered AN group scored significantly higher on the SRS-2 than the control group. This considered, the recovered group mean score was lower than of the acutely unwell AN group, potentially indicating a reduction in ASD traits with recovery.

Social and Emotional Cognition in AN

Social and emotional cognition refers to a complex coalition of psychological and neural processes that encode socially and emotionally relevant inputs, represents their meaning, and guides responses to them (Ochsner, 2008; Pessoa, 2008). Difficulties with social and emotional cognition are principal diagnostic feature of ASD (APA, 2013) and are another area wherein people with AN have been reported to experience increased difficulties. Often conceptualised as separate processes, there is considerable overlap between social and emotional cognition as demonstrated through the respective descriptions. Social cognition refers to processes pertaining to social motivation, social attention and learning (Happé et al., 2017). Emotional cognition, often referred to as emotional intelligence, denotes a person's capacity to identify emotions in oneself and others (Mayer et al., 2016).

Although there is no consensus or agreed-upon theoretical explanation for difficulties in social and emotional cognition in ASD or AN. There is however, evidence to suggest that both conditions experience similar difficulties in this area. Theory of Mind (ToM), empathy and alexithymia represent central and interrelated aspects of social and emotional functioning and represent traits associated with ASD through research. These concepts have been the focus of much of the investigation among people with ASD and AN and therefore, will act as the principal foci for examining social and emotional cognition literature in AN.

Theory of Mind in AN

ToM refers to an individual's social imagination, their capacity to attribute mental states and intentions to others, particularly in terms of understanding that other people have knowledge, thoughts, and motivations different to their own (Pedreño et al., 2017). There is substantive evidence indicating that people with ASD experience significant difficulty in inferring the mental states of others (Baron-Cohen, 2000). ToM difficulties have also been reported through research conducted with people with AN.

Leppanen et al. (2018) conducted a meta-analytic review of studies assessing ToM with people with AN, ASD and healthy controls. Through the analysis, individuals with AN and ASD were reported to perform more poorly than healthy controls across various areas of ToM. These difficulties were more pronounced in the ASD group when compared with the AN group. Through their meta-analysis of 14 studies comparing individuals with acute AN to healthy control groups, Bora and Köse (2016) reported that the AN sample experienced significant difficulties in ToM. Interestingly, meta-regression analysis indicated that ToM difficulties were not as pronounced in recovered cohorts. Analyses also reported that a longer duration of illness and lower BMI scores were associated with more severe deficits in ToM. These additional analyses provide evidence to suggest that impairments may be associated with the state or duration of nutritional deprivation.

More recent research has produced contrasting findings. Kerr-Gaffney et al. (2020) reported no significant differences when assessing emotion recognition abilities between an acutely unwell AN group, a weight restored AN group and healthy controls. Additionally, when assessing ToM, Leslie et al. (2020) found no differences between an acutely unwell AN group, a weight restored AN group and a healthy control sample. Leslie et al. (2020) echo Bora and Köse's (2016) contention that ToM may be impacted by the duration and levels of illness associated nutritional deprivation.

When considering the impact of ASD type traits on ToM in AN, Sedgewick et al. (2019) compared two AN groups, one with high ASD traits and one low in ASD traits. These groups were compared to a healthy control cohort. Despite the author's hypothesis that the AN group with high ASD traits would perform more poorly, no differences were observed across groups regardless of ASD traits.

Of note, in much of the aforementioned research where no differences in ToM were reported (Kerr-Gaffney et al., 2020; Leslie et al., 2020; Sedgewick et al., 2019), these studies were conducted with individuals under the age of 25. As AN typically develops during adolescence or early adulthood and the age of participants in these studies was relatively young, this suggests that the illness duration was limited. The absence of ToM difficulties in these younger cohorts may indicate that impairments in ToM are impacted through periods of prolonged nutritional deprivation as proposed by Leslie et al. (2020) and Bora and Köse (2016). This is further supported through research on ToM conducted amongst adolescents with AN which has generally reported no differences in ToM functioning between young people with AN relative to comparison groups (Laghi et al., 2015; Nalbant et al., 2019; Sfärlea et al, 2018).

Alexithymia

Alexithymia is a subclinical disorder of emotional awareness and processing (Haviland, 2016). People with alexithymia experience difficulties identifying emotions, distinguishing between feelings and bodily sensations of emotional arousal, difficulty describing feelings to other people, and a reduced capacity to fantasise and imagine. They are also proposed to possess a stimulus-bound and an externally oriented cognitive style (Sifneos, 1973). Alexithymia is another trait frequently found at higher rates in ASD and AN groups relative to healthy control samples. Although alexithymia is common in ASD, it is not a universal feature. Approximately half of individuals with ASD are estimated as having alexithymia, where it is thought that this may represent a specific ASD sub-group (Kinnaird et al., 2019; Poquérusse et al., 2018).

A meta-analysis assessing alexithymia through the 20-item Toronto Alexithymia Scale (TAS-20) indicated that compared to controls, alexithymia among AN samples was significantly more prevalent with a large effect size reported (Westwood et al., 2017). This was also the case for TAS-20 subscales with a large effect size observed for the Difficulty Identifying Feelings and Difficulty Describing Feelings subscales. For the Externally Orientated Thinking subscale,

a small effect size was observed. Meta-regression analyses indicated that there were was increased alexithymia in older AN groups.

Alexithymia research conducted with recovered groups has reported mixed findings. Strigo et al. (2013) reported that individuals who had recovered from AN did not differ significantly from healthy controls with regard to reported levels of alexithymia. The opposite of this was reported by Kerr-Gaffney et al. (2020), where they compared levels of alexithymia in a group with acute AN, a recovered cohort and a healthy control sample. Findings indicated a significant difference between groups, with the recovered AN group representing a mid-point between those with acute AN and healthy controls.

Alexithymia research with younger individuals has been limited. Where it has been conducted, acutely ill adolescents were also seen to experience higher levels of alexithymia than healthy peers across two studies (Peres et al., 2020; Nalbant et al., 2019). This considered, this cohort remains understudied with regard to alexithymia.

Empathy

Empathy refers to the ability to understand, identify and share the mental states of others (Greenberg et al., 2001). Empathy is at times subdivided into two subcategories. Cognitive empathy refers to the ability to recognise and understand another's mental state and is linked with ToM, while affective empathy denotes emotional stimulation in response to the display or experience of emotions by others (Blair, 2005). As described previously, atypical empathic responses are common in ASD (Baron-Cohen, 2010).

A meta-analysis of 14 studies considering empathy in AN reported no difference in overall empathy scores between people with AN and healthy controls. An additional analysis of 8 studies that allowed for the evaluation of cognitive empathy did report that individuals with AN had lower scores in this domain with a small effect size (Kerr-Gaffney et al., 2019).

Subsequent to this analysis, Kerr-Gaffney et al. (2020) examined cognitive and affective empathy in a cohort with AN, those recovered, and healthy controls through performance based measures of empathy; this was in conjunction with measuring ASD traits through the ADOS-2. Although a significant difference was reported for ASD traits across all groups, findings between groups were non-significant for empathy. However, both ASD traits and empathy in the recovered AN group reflected an intermediate profile between those acutely unwell and healthy controls. Morris et al. (2014) also examined empathy across an acute AN cohort, a recovered cohort and healthy controls. Similarly to the previous study, no significant difference across groups was reported, although the recovered cohort represented an approximate mid-point between the acutely unwell AN group and healthy controls.

When considering research pertaining to adolescents with AN specifically, Calderoni et al. (2015) utilised, the Interpersonal Reactivity Index to examine differences between adolescents with AN and healthy controls. Findings indicated a significant difference between the AN group and the control group on the Cognitive Empathy scale, in addition to the Perspective Taking and Fantasy subscales. There was no difference between groups on the Affective Empathy scale, Empathetic Concern or Personal Distress subscales. Findings contrasting these were reported by Peres et al. (2020) among adolescents with AN and a control group. Results indicated the AN group reported more difficulties with Affective Empathy and the Personal Distress subscale than the healthy control sample. There were no differences reported on the cognitive empathy scale or subscales that make this up. When considering the aforementioned scales and subscales on the Interpersonal Reactivity Index, Schulte-Rüther et al. (2012) did not observe any differences between adolescents with AN and healthy control participants. Baron-Cohen et al. (2013) also reported no difference on the self-reported Empathy Quotient in a sample of adolescents with AN when compared to a control group. Nalbant et al. (2019) also reported significantly lower levels of emotional and cognitive empathy in a AN group when

compared to healthy adolescents when using KA-SI Empathic Tendency Scale. Overall, through an examination of the prior research with adolescents, there have been mixed findings with regard to empathy in AN which has not allowed for conclusions to be drawn on the nature of this difficulty in AN.

Theoretical Explanations for ASD Traits in AN

There is significant uncertainty surrounding the aetiology of ASD and associated traits reported in AN where a number of potential hypothesises have been tendered. One such hypothesis is that ASD and associated traits may represent an innate neurodevelopmental disposition which may be associated with an increased risk for AN in females. As described through the second iteration of the Cognitive-Interpersonal Maintenance Model of AN, Treasure and Schmidt (2013) propose that certain traits lead to an increased vulnerability to AN and also contribute to the maintenance of the disorder. These traits pertain to cognitive, social and emotional functioning evidenced within the AN literature such as difficulties with set-shifting, weak central coherence, poor interpretation of social signals and difficulties understanding the perspectives of others. They propose that these traits act as vulnerability factors that predate illness onset. Although the authors contend that these traits may be obsessive-compulsive in nature, given the considerable amount of research highlighting the similarities in profiles of AN and ASD these may be more appropriately categorised as sub-threshold ASD traits.

Baron-Cohen et al. (2013) provided further evidence for the neurodevelopmental hypothesis and the role ASD traits may play in the development of AN through their evaluation of ASD traits, systemising and empathising in adolescent females with AN. Analyses conducted with 66 adolescents with AN, 1,609 healthy controls and their parents indicated that the AN cohort were reported to have significantly higher AQ and systemising scores. The AN group was deemed to represent a "systemising significantly better than empathy" profile consistent with the BAP (Baron-Cohen et al., 2013, p. 5). When considering the association between ASD

traits and AN, the authors hypothesise that these traits may act as a risk factor through individuals being drawn towards the "systematised" relationship between food and weight. This systematised relationship with food may also become more exaggerated and compounded by other traits associated with ASD such as intense preoccupation and cognitive rigidity (Baron-Cohen, 2002).

An alternative explanation for this is that people with AN come to develop traits associated with ASD is due to the physiological sequelae associated with the nutritional deprivation of the illness (Westwood et al., 2018). The physiological and psychological consequences of starvation are well documented (Keys, 1950). Neurophysiological mechanisms linked with the nutritional deprivation experienced in AN include reduced grey and white brain matter, with more pronounced reductions associated with low weight and illness duration (Seitz et al., 2018). This is something hypothesised to result in a "neurological scar effect" and has been proposed to explain difficulties in cognitive flexibility, weak central coherence, ToM and emotion recognition, all of which are consistent with ASD (Lang et al., 2014; Saure et al., 2020). This considered, neurophysiological changes in AN have been reported to be reversible over the course of 4-6 months through weight restoration, with age-related plasticity reported to impact levels of brain restitution (Kaufmann et al., 2020).

Neurophysiological changes associated with acute starvation are potentially reflected through studies examining differences in ASD observational measures, screening instruments and measures of emotional cognition among individuals with AN and recovered groups. For example, both Sedgewick et al. (2019) and Kerr-Gaffney et al. (2020) reported reduced scores for recovered cohorts on the ADOS-2, and also the SRS-2 in the case of the latter study. This is in addition to reduced scores on the AQ for a recovered AN group as reported by Karjalainen et al. (2019). Bora and Köse (2016) also reported reduced ToM difficulties in recovered groups through their meta-analysis. Lower levels of alexithymia have also been reported in recovered

AN groups (Kerr-Gaffney et al., 2020). Similar findings have also been reported among studies considering aspects of cognitive functioning (Tomba et al., 2019). In some instances, recovered group scores across various measures considered represent an approximate midpoint between the scores of those with acute AN and healthy comparisons. This provides some evidence for the potential impact of starvation and reduction in ASD traits with weight restoration.

Another hypothesis combines both the neurodevelopmental and physiological starvation positions and proposes that pre-existing ASD traits become exacerbated due to periods of extended nutritional deprivation (Westwood et al., 2018). This is also contended through the Cognitive-Interpersonal Maintenance Model of AN (Treasure & Schmidt, 2013). Given that the onset of the illness is typical during adolescence (Volpe et al., 2016), extended periods of starvation and the associated neurophysiological consequences may present as increased ASD traits among adult AN research groups. Evidence to support this hypothesis can be drawn from studies considering the prevalence of these traits in groups with recent-onset or in adolescents.

Meta-analyses considering ASD traits as measured through the AQ among children and adolescents with AN report reduced traits in these groups when compared to adult cohorts (Westwood et al., 2016). Support for this contention can also be drawn from studies conducted with young people under the age of twenty-five where no differences in ToM were reported (Kerr-Gaffney et al., 2020; Leslie et al., 2020; Sedgewick et al., 2019), or through meta-analysis where impairment in ToM was reportedly associated with the duration of nutritional deprivation (Bora & Köse, 2016). Additionally, research considering ToM among adolescents with AN has generally reported no differences in ToM functioning between young people with AN and their healthy peers (Laghi et al., 2015; Nalbant et al., 2019; Sfärlea et al, 2018). With regards to empathy, research with young people and adolescents has produced mixed findings (Baron-Cohen et al., 2013; Calderoni et al., 2013; Nalbant et al., 2019; Peres et al., 2020). This is also the case for alexithymia (Goozen et al., 2004; Nalbant et al., 2019; Peres et al., 2020),

thus not allowing for definitive conclusions surrounding the impact starvation may have on these processes. This considered, there is some evidence to suggest that difficulties with social and emotional cognition are either less pronounced or not apparent in younger cohorts or where there the period of nutritional deprivation is not prolonged.

Conclusion

AN and ASD both represent complex and significant conditions associated with significant impairments in functioning. Despite differences in respective diagnostic criteria and epidemiological profile of individuals who experience AN and ASD, research has provided evidence for commonalities in the profiles of both conditions.

Research pertaining to AN specifically has indicated that this group commonly experience difficulties consistent with ASD. This has been reflected through best practice diagnostic instruments, common observational tools and screening measures. There is also evidence to suggest that both disorders may share a common social and emotional phenotype as examined through research in ToM, empathy and alexithymia.

Research with acutely unwell adult AN groups has indicated that this cohort exhibit a higher prevalence of ASD traits relative to healthy control samples. Studies have also indicated that ASD traits appear to be reduced within recovered groups. Additionally, evidence regarding the prevalence of these traits in groups with younger cohorts remains unclear with difficulties either less pronounced or not apparent. However, there has been limited research conducted with younger cohorts with AN.

A number of explanations have been tendered to account for similarities between the conditions. One such suggests that pre-existing neurodevelopmental disposition consistent with ASD and associated with various cognitive, social and emotional difficulties, and a propensity to systematise may act as a vulnerability factor for AN. This is supported by research

identifying the genetic heritability of both disorders. Another viewpoint posits that these traits may be as a result of the physiological sequelae associated with the nutritional deprivation of the illness. An alternative explanation combines both perspectives through suggesting that pre-existing ASD traits become exacerbated due to periods of extended nutritional deprivation associated with AN. Notwithstanding increased research interest in this area, there is no consensus within the existing literature to account for the similarities in these presentations.

References

Allely, C. (2019). Exploring the female autism phenotype of repetitive behaviours and restricted interests (RBRIs): a systematic PRISMA review. *Advances in Autism, 5*(3), 171-186. doi:10.1108/AIA-09-2018-0030

Amianto, F., Abbate-Daga, G., Morando, S., & Sobre, C. (2011). Personality development characteristics of women with anorexia nervosa, their healthy siblings and healthy controls: What prevents and what relates to psychopathology? *Psychiatry Research, 187*(3), 401-408.

APA. (2013). *Diagnostic and statistical manual of mental disorders.* Washington DC: American Psychiatric Publishing.

Autism and Developmental Disabilities Network. (2020). *Community Report on Autism.* Centers for Disease Control and Prevention. Retrieved from https://www.cdc.gov/ncbddd/autism/addm-community-report/documents/addm-community-report-2020-h.pdf

Baron-Cohen, S. (2000). Theory of Mind and Autism: A Review. *International Review of Research in Mental Retardation, 23*, 169-184.

Baron-Cohen, S. (2002). The extreme male brain theory of autism . *Trends in Cognitive Sciences, 6*(6), 248-254.

Baron-Cohen, S. (2009). Autism: The Empathising–Systemizing (E-S) Theory. *Developmental social cognitive neuroscience*, 125-138.

Baron-Cohen, S. (2010). Empathising, systemising, and the extreme male brain theory of autism. *Progress in Brain Research, 186*, 167-175.

Baron-Cohen, S., Auyeung, B., Ashwin, E., Knickmeyer, R., Lombardo, M., & Chakrabarti, B. (2011). The Extreme Male Brain Theory of Autism: The Role of Fetal Androgens. In D. Amaral, D. Geschwind, & G. Dawson (Eds.), *Autism Spectrum Disorders*. Oxford University Press.

Baron-Cohen, S., Jaffa, T., Davies, S., Auyeung, B., Allison, C., & Wheelwright, S. (2013). Do girls with anorexia nervosa have elevated autistic traits? *Molecular Autism, 4*(24). doi:https://doi.org/10.1186/2040-2392-4-24

Baron-Cohen, S., Tsompanidis, A., Auyeung, B., Nørgaard-Pedersen, B., Hougaard, D. M., Abdallah, M., . . . Pohl, A. (2020). Foetal oestrogens and autism. *Molecular Psychiatry, 25*, 2970–2978.

Baron-Cohen, S., Wheelwright, S., Hill, J., Raste, Y., & Plumb, I. (2001). The "Reading the mind in the eyes" Test revised version: A study with normal adults, and adults with Asperger syndrome or high-functioning autism. *Journal of Child Psychology and Psychiatry, 42*(2), 241-251.

Baron-Cohen, S., Wheelwright, S., Skinner, R., Martin, J., & Clubley, E. (2001). The Autism-Spectrum Quotient (AQ): Evidence from Asperger Syndrome/High-Functioning Autism, Malesand Females, Scientists and Mathematicians. *Journal of Autism and Developmental Disorders, 31*, 5-17.

Baxter, A. J., Brugha, T. S., Erskine, H. E., Scheurer, R. W., Vos, T., & Scott, J. G. (2015). The epidemiology and global burden of autism spectrum disorders. *Psychological Medicine, 54*(3), 601-613.

Begeer, S., Mandell, D., Venderbosch, B. W.-H., Rem, D., Stekelenburg, F., & Koot, H. M. (2013, May). Sex Differences in the Timing of Identification Among Children and

Adults with Autism Spectrum Disorders. *Journal of Autism and Developmental Disorders, 43,* 1151–1156. doi:https://doi.org/10.1007/s10803-012-1656-z

Bem, S. L. (1981). Gender Schema Theory: A Cognitive Account of Sex Typing. *Psychological Review, 88*(4), 354-364.

Ben-Sasson, Hen, L., Fluss, R., Cermak, S. A., Engel-Yeger, B., & Gal, E. (2009). A meta-analysis of sensory modulation symptoms in individuals with autism spectrum disorders Ayelet. *Journal of Autism and Developmental disorders, 39*(1), 1-11. doi:10.1007/s10803-008-0593-3

Billington, J., Baron-Cohen, S., & Wheelwright, S. (2007). Cognitive style predicts entry into physical sciences and humanities: Questionnaire and performance tests of empathy and systemising. *Learning and Individual Differences, 17,* 260–268.

Blair, R. (2005). Responding to the emotions of others: Dissociating forms of empathy through the study of typical and psychiatric populations. *Consciousness and Cognition, 14*(4), 698-718.

Bölte, S., Girdler, S., & Marschik, P. B. (2019). The contribution of environmental exposure to the etiology of autism spectrum disorder. *Cellular and Molecular Life Sciences, 76,* 1275–1297.

Booth, T., Murray, A. L., McKenzie, K., Kuenssberg, R., O'Donnell, M., & Burnett, H. (2013). Brief Report: An Evaluation of the AQ-10 as a Brief Screening Instrument for ASD in Adults. *Journal of Autism and Developmental Disorders, 43,* 2997–3000.

Bora, E., & Köse, S. (2016). Meta-analysis of theory of mind in anorexia nervosa and bulimia nervosa: A specific İmpairment of cognitive perspective taking in anorexia nervosa? *International Journal of Eating Disorders, 49*(8), 739-740.

Brand-Gothelf, A., Parush, S., Eitan, Y., Admoni, S., Gur, E., & Stein, D. (2016). Sensory modulation disorder symptoms in anorexia nervosa and bulimia nervosa: A pilot study. *The International Journal of Eating Disorders, 49*(1), 59-68. doi:10.1002/eat.22460

Calderoni, S., Fantozzi, P., Balboni, G., Pagni, V., Franzoni, E., Apicella, F., ... & Muratori, F. (2015). The impact of internalising symptoms on autistic traits in adolescents with restrictive anorexia nervosa. *Neuropsychiatric Disease and Treatment, 11*, 75.

Calderoni, S., Fantozzi, P., Maestro, S., Brunori, E., Narzisi, A., Balboni, G., & Muratori, F. (2013). Selective cognitive empathy deficit in adolescents with restrictive anorexia nervosa. *Neuropsychiatric Disease and Treatment, 9*, 1583-1589.

Cath, D., Ran, N., Smit, J., Balkom, A. v., & Comijs, H. (2008). Symptom Overlap between Autism Spectrum Disorder, Generalized Social Anxiety Disorder and Obsessive-Compulsive Disorder in Adults: A Preliminary Case-Controlled Study. *Psychopathology, 41*, 101–110.

Charman, T., Pickles, A., Simonoff, E., Chandler, S., Loucas, T., & Baird, G. (2011). IQ in children with autism spectrum disorders: data from the Special Needs and Autism Project (SNAP). *Psychological Medicine, 41*(3), 619-627.

Chen, A., & Couturier, J. (2019). Triggers for Children and Adolescents with Anorexia Nervosa: A Retrospective Chart Review. *Journal of the Canadian Academy of Child and Adolescent Psychiatry, 28*(3), 134–140.

Constantino, J., & Gruber, C. (2012). *Social Responsiveness Scale, Second Edition* . Torrance, CA: Western Psychological Services.

Courty, A., Maria, A. S., Lalanne, C., Ringuenet, D., Vindreau, C., Chevallier, C., . . . Berthoz, S. (2013). Levels of autistic traits in anorexia nervosa: a comparative psychometric study. *BMC Psychiatry, 13*(1). doi:https://doi.org/10.1186/1471-244X-13-222

Cresswell, L., Hinch, R., & Cage, E. (2019). The experiences of peer relationships amongst autistic adolescents: A systematic review of the qualitative evidence. *Research in Autism Spectrum Disorders*, 45-60. doi:doi.org/10.1016/j.rasd.2019.01.003

Dahlenburg, S. C., Gleaves, D. H., & Hutchinson, A. D. (2019). Anorexia nervosa and perfectionism: A meta-analysis. *International Journal of Eating Disorders, 52*(3), 219-229.

Dahlgren, C. L., Hage, T. W., Wonderlich, J. A., & Stedal, K. (2019). General and Eating Disorder Specific Flexibility: Development and Validation of the Eating Disorder Flexibility Index (EDFLIX) Questionnaire. *Frontiers Psychology, 10*(663).

Fairburn, C. (2008). *Cognitive Behavior Therapy and Eating Disorders.* Guilford Press.

Fairburn, C. G., Cooper, Z., Doll, H. A., & Welsh, S. L. (1999). Risk Factors for Anorexia Nervosa; Three Integrated Case-Control Comparisons. *JAMA Psychiatry, 56*(5), 468-476.

Gerdts, J., & Bernier, R. (2011). The Broader Autism Phenotype and Its Implications on the Etiology and Treatment of Autism Spectrum Disorders. *Autism Research and Treatment, 2011*.

Greenberg, D. M., Warrier, V., Allison, C., & Baron-Cohen, S. (2018). Testing the Empathising–Systemising theory of sex differences and the Extreme Male Brain theory of autism in half a million people. *Proceedings of the National Academy of Sciences of the United States of America, 115*(48), 12152–12157.

Greenberg, L. S., Elliott, R., Watson, J. C., & Bohart, A. C. (2001). Empathy. *Psychotherapy: Theory, research, practice, training*, *38*(4), 380.

Happé, F., Cook, J., & Bird, G. (2017). The structure of social cognition: In(ter)dependence of sociocognitive processes. . *Annual Review of Psychology , 68*, 243–267.

Harmsen, I. E. (2019). Empathy in Autism Spectrum Disorder. *Journal of Autism and Developmental Disorders*, *49*(10), 3939–3955.

Harrison, A., Tchanturia, K., Naumann, U., & Treasure, J. (2012). Social emotional functioning and cognitive styles in eating disorders. *British Journal of Clinical Psychology, 51*, 261–279.

Haviland, M. (2016). Alexithymia. In H. S. Friedman (Ed.), *Encyclopedia of Mental Health (Second Edition)* (pp. 47-53). Academic Press.

Hull, L., Petrides, K., & Mandy, W. (2020). The Female Autism Phenotype and Camouflaging: a Narrative Review. *Review Journal of Autism and Developmental Disorders, 8*, 306–317.

Joel, D., Berman, Z., Tavor, I., Wexler, N., Gaber, O., Stein, Y., . . . Assaf, Y. (2015). Sex beyond the genitalia: The human brain mosaic. *Proceedings of the National Academy of Sciences of the United States of America, 112*(50), 15468-15473.

Karjalainen, L., Råstam, M., Paulson-Karlsson, G., & Wentz, E. (2019). Do autism spectrum disorder and anorexia nervosa have some eating disturbances in common? *European Child & Adolescent Psychiatry*, 69-78. doi:10.1007/s00787-018-1188-y

Kaufmann, L.-K., Hänggi, J., Jäncke, L., Baur, V., Piccirelli, M., Kollias, S., . . . Milos, G. (2020). Age influences structural brain restoration during weight gain therapy in anorexia nervosa. *Translational Psychiatry, 10*(126).

Kerr-Gaffney, J., Harrison, A., & Tchanturia, K. (2019). Cognitive and Affective Empathy in Eating Disorders: A Systematic Review and Meta-Analysis. *Frontiers in Psychiatry, 10*. doi:10.3389/fpsyt.2019.00102

Kerr-Gaffney, J., Harrison, A., & Tchanturia, K. (2020). Autism spectrum disorder traits are associated with empathic abilities in adults with anorexia nervosa. *Journal of Affective Disorders, 266*, 273-281.

Kerr-Gaffney, J., Mason, L., Jones, E., Hayward, H., Ahmad, J., Harrison, A., . . . Tchanturia, K. (2020). Emotion Recognition Abilities in Adults with Anorexia Nervosa are Associated with Autistic Traits. *Journal of Clinical Medicine, 9*(1057).

Keys, A. (1950). *The biology of human starvation.* Minneapolis: :University of Minnesota Press.

Kinnaird, E., & Tchanturia, K. (2021). Looking beneath the surface: Distinguishing between common features in autism and anorexia nervosa. *Journal of Behavioral and Cognitive Therapy, 31*, 3-13.

Kinnairda, E., Stewart, C., & Tchanturia, K. (2019). Investigating alexithymia in autism: A systematic review and meta-analysis. *European Psychiatry, 55*, 80-89.

Kloosterman, P. H., Keefer, K. V., Kelley, E. A., Summerfeldt, L. J., & Parker, J. D. (2011). Evaluation of the factor structure of the Autism-Spectrum Quotient. *Personality and Individual Differences, 50*(2), 310-314.

Laghi, F., Pompili, S., Zanna, V., Castiglioni, M. C., Criscuolo, M., Chianello, I., . . . Baiocco, R. (2015). Are adolescents with anorexia nervosa better at reading minds? *Cognitive Neuropsychiatry, 12*(6), 489-501.

Lai, M.-C., Lombardo, M. V., & Baron-Cohen, S. (2014). Autism. The Lancet, 838(9920), 896-910.

Lai, M.-C., Lombardo, M. V., Ruigrok, A. N., Chakrabarti, B., Auyeung, B., Szatmari, P., . . . Baron-Cohen, S. (2017). Quantifying and exploring camouflaging in men and women with autism. *Autism, 21*(6), 690-702. doi:10.1177/1362361316671012

Landry, O., & Al-Taie, S. (2016). A Meta-analysis of the Wisconsin Card Sort Task in Autism. *Journal of Autism and developmental disorders, 46*, 1220–1235.

Lang, K., Roberts, M., Harrison, A., Lopez, C., Goddard, E., Khondoker, M., . . . Tchanturia, K. (2016). entral Coherence in Eating Disorders: A Synthesis of Studies Using the Rey Osterrieth Complex Figure Test. *PLOS One, 11*(11).

Leppanen, J., Sedgewick, F., Treasure, J., & Tchanturia, K. (2018). Differences in the Theory of Mind profiles of patients with anorexia nervosa and individuals on the autism spectrum: A meta-analytic review. *Neuroscience and Biobehavioral Reviews, 90*, 146-163.

Leslie, M., Halls, D., Leppanen, J., Sedgewick, F., Smith, K., Hayward, H., . . . Tchanturia, K. (2020). Neural Correlates of Theory of Mind Are Preserved in Young Women With Anorexia Nervosa. *Frontiers in Psychology, 11*. doi: https://doi.org/10.3389/fpsyg.2020.568073

Loomes, R., Hull, L., & Mandy, W. P. (2017). What Is the Male-to-Female Ratio in Autism Spectrum Disorder? A Systematic Review and Meta-Analysis. *Journal of the American Academy of Child & Adolescent Psychiatry, 56*(6), 466-474. doi:https://doi.org/10.1016/j.jaac.2017.03.013

Lopez, C., Stahl, D., & Tchanturia, K. (2010). Estimated intelligence quotient in anorexia nervosa: a systematic review and meta-analysis of the literature. *Annals of General Psychiatry, 9*(40).

Lord, C., Brugha, T., Charman, T., Cusack, J., Dumas, G., Frazier, T., . . . al, e. (2020). Autism spectrum disorder. *Nature reviews Disease primers, 6*(1).

Marı´-Bauset, S., Zazpe, I., Mari-Sanchis, A., Llopis-Gonza´lez, A., & Morales-Sua´rez-Varela, M. (2014). Food Selectivity in Autism Spectrum Disorders: A Systematic Review. *Journal of Child Neurology, 29*(11), 1554-1561.

Mason, T. B., Lesser, E. L., Dolgon-Krutolow, A. R., Wonderlich, S. A., & Smith, K. E. (2020). An updated transdiagnostic review of social cognition and eating disorder psychopathology. *Journal of Psychiatric Research, 20*(3). doi:10.1016/j.jpsychires.2020.11.019

Mayer, J. D., Caruso, D. R., & Salovey, P. (2016). The ability model of emotional intelligence: Principles and updates. *Emotion Review, 8*, 1-11.

Mazzeo, S. E., & Bulik, C. M. (2010). Environmental and genetic risk factors for eating disorders: What the clinician needs to know. *Child and Adolescent Psychiatric Clinics of North America ., 18*(1), 67–82.

Mitchell, P., Sheppard, E., & Cassidy, S. (2021). Autism and the double empathy problem: Implications for development and mental health. *British Journal of Developmental Psychology, 39*, 1-18. doi:10.1111/bjdp.12350

Morris, R., Bramham, J., Smith, E., & Tchanturia, K. (2014). Empathy and social functioning in anorexia nervosa before and after recovery. *Cognitive Neuropsychiatry, 19*(1), 47-57.

Moskowitz, L., & Weiselberg, E. (2017). Anorexia Nervosa/Atypical Anorexia Nervosa. *Current Problems in Pediatric and Adolescent Health Care, 47*(4), 70-84.

Nalbant, K., Kalaycı, B. M., Akdemir, D., Akgül, S., & Kanbur, N. (2019). Emotion regulation, emotion recognition, and empathy in adolescents with anorexia nervosa. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity, 24*, 825–834.

NICE. (2017, December 20). *Autism spectrum disorder in under 19s: recognition, referral and diagnosis.* Retrieved January 15, 2021, from National Institute for Health and Care Excellence: https://www.nice.org.uk/guidance/cg128/chapter/Recommendations#autism-diagnostic-assessment-for-children-and-young-people

Ochsner, K. N. (2008). The social-emotional processing stream: Five core constructs and their translational potential for schizophrenia and beyond. *Biological Psychiatry, 64*(1), 48–61.

Pedreño, C., Pousa, E., Navarro, J. B., Pàmias, M., & Obiols, J. E. (2017). Exploring the Components of Advanced Theory of Mind in Autism Spectrum Disorder. *Journal of Autism and Developmental Disorders, 47*, 2401–2409.

Peres, V., Corcos, M., Robin, M., & Pham-Scottez, A. (2018). Emotional intelligence, empathy and alexithymia in anorexia nervosa during adolescence. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*, 1-8. doi:doi.org/10.1007/s4051

Pessoa, L. (2008). On the relationship between emotion and cognition. *Nature Reviews Neuroscience, 9*(2), 148-158.

Pisula, E., & Ziegart-Sadowska, K. (2015). Broader Autism Phenotype in Siblings of Children with ASD: a Review. *International Journal of Molecular Sciences, 16*, 13217-13258.

Piven, J., & Benjamin, J. (2002). The genetics of personality: the example of the broad autism phenotype. *Molecular Genetics and the Human Personality,* 43- 62.

Poquérusse, J., Pastore, L., Dellantonio, S., & Esposito, G. (2018). Alexithymia and Autism Spectrum Disorder: A Complex Relationship. *Frontiers in Psychology, 9*. doi:10.3389/fpsyg.2018.01196

Postorino, V., Scahill, L., Peppo, L. D., Fatta, L. M., Zanna, V., Castiglioni, M. C., . . . Mazzone, L. (2017). Investigation of Autism Spectrum Disorder and Autistic Traits in an Adolescent Sample with Anorexia Nervosa. *Journal of Autism and Developmental Disorders, 47*(4), 1051-1061. doi:10.1007/s10803-016-3023-y

Rubenstein, E., & Chawla, D. (2018). Broader autism phenotype in parents of children with autism: a systematic review of percentage estimates. *Journal of Child and Family Studies, 27*(6), 1705-1720.

Sampaio, F. T., Soneira, S., Aulicino, A., Martese, G., Iturry, M., & Allegri, R. F. (2013). Theory of mind and central coherence in eating disorders: Two sides of the same coin? *Psychiatry Research, 3*, 1116-1122.

Schmidt, U., & Treasure, J. (2006). Anorexia nervosa: Valued and visible. A cognitive-interpersonal maintenance model and its implications for research and practice. *British Journal of Clinical Psychology, 45*, 343–366.

Schulte-Rüther, M., Mainz, V., Fink, G. R., Beate, Herpertz-Dahlmann, & Konrad, K. (2012). Theory of Mind and the Brain in Anorexia Nervosa: Relation to Treatment Outcome. *Journal of the American Academy of Child & Adolescent Psychiatry, 51*(8), 832-841.

Sedgewick, F., Kerr-Gaffney, J., Leppanen, J., & Tchanturia, K. (2019). Anorexia Nervosa, Autism, and the ADOS: How Appropriate Is the New Algorithm in Identifying Cases? *Frontiers in Psychiatry, 10*.

Sedgewick, F., Leppanen, J., Goh, F., Hayward, H., Happé, F., & Tchanturia, K. (2019). Similarities and Differences in Theory of Mind Responses of Patients With Anorexia Nervosa With and Without Autistic Features. *Frontiers in Psychiatry, 10*. doi:10.3389/fpsyt.2019.00318

Seitz, J., Konrad, K., & Herpertz-Dahlmann, B. (2018). Extend, Pathomechanism and Clinical Consequences of Brain Volume Changes in Anorexia Nervosa. *Current Neuropharmacology, 16*(8), 1164–1173. doi:10.2174/1570159X15666171109145651

Sfärlea, A., Greimel, E., Platt, B., Dieler, A. C., & Schulte-Körne, G. (2018). Recognition of emotional facial expressions in adolescents with anorexia nervosa and adolescents with major depression. *Psychiatry Research, 262*, 586-594.

Sharp, W. G., Postorino, V., McCracken, C. E., Berry, R. C., Burrell, K. K., & Scahill, L. (2018). Dietary Intake, Nutrient Status, and Growth Parameters in Children with Autism Spectrum Disorder and Severe Food Selectivity: An Electronic Medical Record Review Author links open overlay panel. *Journal of the Academy of Nutrition and Dietetics, 118*(10), 1943-1950.

Sifneos, P. E. (1973). The prevalence of 'Alexithymic' characteristics in psychosomatic patients. *22*(2-6), 55–262.

Smink, F. R., Hoeken, D. v., & Hoek, H. W. (2012). Epidemiology of eating disorders: incidence, prevalence and mortality rates. *Current Psychiatry Reports, 14*(4), 406-414.

Spek, A. A., Rijnsoever, W. v., Laarhoven, L. v., & Kiep, M. (2020). Eating Problems in Men and Women with an Autism Spectrum Disorder. *Journal of Autism and Developmental Disorders, 50*(5), 1748-1755.

Stedal, K., Rose, M., Frampton, I., Landrø, N. I., & Lask, B. (2012). The Neuropsychological Profile of Children, Adolescents, and Young Adults with Anorexia Nervosa. *Archives of Clinical Neuropsychology*, *27*(3), 329–337.

Stewart, M. E., & Austin, E. J. (2009). The structure of the Autism-Spectrum Quotient (AQ): Evidence from a student sample in Scotland. *Personality and Individual Differences, 47*(3), 224-228.

Strigo, I. A., Matthews, S. C., Simmons, A. N., Oberndorfer, T., Klabunde, M., Reinhardt, L. E., & Kaye, W. H. (2013). Altered insula activation during pain anticipation in individuals recovered from anorexia nervosa: evidence of interoceptive dysregulation. *International Journal of Eatign Disorders, 46*(1), 23–33.

Tchanturia, K. (2021). *Supporting Autistic People with Eating Disorders: A Guide to Adapting Treatment and Supporting Recovery.* London: Jessica Kingsley Publishers .

Tchanturia, K., Lloyd, S., & Lang, K. (2013). Cognitive Remediation Therapy for Anorexia Nervosa: Current Evidence and Future Research Directions. *International Journal of Eating Disorders, 46*(5), 492–495.

Thornton, L. M., Mazzeo, S. E., & Bulik, C. M. (2011). The Heritability of Eating Disorders: Methods and Current Findings. *Current Topics in Behavioral Neurosciences, 6*, 141–156.

Tomba, E., Tecuta, L., Crocetti, E., Squarcio, F., & Tomei, G. (2019). Residual eating disorder symptoms and clinical features in remitted and recovered eating disorder patients: A

systematic review with meta-analysis. *The International Journal of Eating Disorders, 52*(7), 759-776.

Tozzi, F., Sullivan, P. F., Fear, J. L., McKenzie, J., & Bulik, C. M. (2003). Causes and recovery in anorexia nervosa: the patient's perspective. *International Journal of Eating Disorders, 33*(2), 143-154.

Treasure, J., & Schmidt, U. (2013). The cognitive-interpersonal maintenance model of anorexia nervosa revisited: a summary of the evidence for cognitive, socio-emotional and interpersonal predisposing and perpetuating factors. *Journal of Eating Disorders*, 1-13.

Treasure, J., Duarte, T. A., & Schmidt, U. (2020). Eating disorders. *The Lancet, 395*, 899–911.

Treasure, J., Willmott, D., Ambwani, S., Cardi, V., Bryan, D. C., Rowlands, K., & Schmidt, U. (2020). Cognitive Interpersonal Model for Anorexia Nervosa Revisited: The Perpetuating Factors that Contribute to the Development of the Severe and Enduring Illness. *Journal of Clinical Medicine, 9*(630).

Volpe, U., Tortorella, A., Manchia, M., Monteleone, A. M., Albert, U., & Monteleone, P. (2016). Eating disorders: What age at onset? *Psychiatry Research, 238,* 225-227.

Vorstman, J. A., Parr, J. R., Moreno-De-Luca, D., Anney, R. J., Jr, J. I., & Hallmayer, J. F. (2017). Autism genetics: opportunities and challenges for clinical translation. *Nature Reviews Genetics, 18,* 362–376.

Watson, H. J., Yilmaz, Z., Thornton, L. M., Hübel, C., Coleman, J. R., Gaspar, H. A., . . . al., . (2019). Genome-wide Association Study Identifies Eight Risk Loci and Implicates Metabo-Psychiatric Origins for Anorexia Nervosa. *Nature Genetics, 51*(8), 1207–1214. doi:10.1038/s41588-019-0439-2

Westwood, H., & Tchanturia, K. (2017). Autism Spectrum Disorder in Anorexia Nervosa: An Updated Literature Review. *Current Psychiatry Reports, 7*(41).

Westwood, H., & Tchanturia, K. (2017). Autism Spectrum Disorder in Anorexia Nervosa: An Updated Literature Review. *Current Psychiatry Reports, 19*(7), 1535-1645. doi:10.1007/s11920-017-0791-9

Westwood, H., Eisler, I., Mandy, W., Leppanen, J., Treasure, J., & Tchanturia, K. (2016). Using the Autism-Spectrum Quotient to Measure Autistic Traits in Anorexia Nervosa: A Systematic Review and Meta-Analysis. *Journal of Autism and Developmental Disorder, 46*(3), 964-77.

Westwood, H., Kerr-Gaffney, J., Stahl, D., & Tchanturia, K. (2017). Alexithymia in eating disorders: Systematic review and meta-analyses of studies using the Toronto Alexithymia Scale. *Journal of Psychosomatic Research, 99*, 66-81.

Westwood, H., Mandy, W., & Tchanturia, K. (2017). Clinical evaluation of autistic symptoms in women with anorexia nervosa. *Molecular Autism, 8*(12). doi:10.1186/s13229-017-0128-x

Westwood, H., Mandy, W., & Tchanturia, K. (2017). The association between symptoms of autism and neuropsychological performance in females with Anorexia Nervosa. *Psychiatry Research, 258*, 531-537.

Westwood, H., Mandy, W., Simic, M., & Tchanturia, K. (2018). Assessing ASD in Adolescent Females with Anorexia Nervosa using Clinical and Developmental Measures: a Preliminary Investigation. *Journal of Abnormal Child Psychology, 46*(1), 183–192.

Westwood, H., Stahl, D., Mandy, W., & Tchanturia, K. (2016). The set-shifting profiles of anorexia nervosa and autism spectrum disorder using the Wisconsin Card Sorting Test:

a systematic review and meta-analysis. *Psychological Medicine, 46*, 1809–1827. doi:doi:10.1017/S0033291716000581

Wheeler, S. C., & Petty, R. E. (2001). The effects of stereotype activation on behavior: A review of possible mechanisms. *Psychological Bulletin, 127*(6), 797–826.

Wouters, S., & Spekb, A. (2011). The use of the Autism-spectrum Quotient in differentiating high-functioning adults with autism, adults with schizophrenia and a neurotypical adult control group. *Research in Autism Spectrum Disorders, 5*(3), 1169-1175.

Yilmaz, Z., Hardaway, A., & Bulik, C. M. (2015). Genetics and Epigenetics of Eating Disorders. *Advances in Genomics and Genetics, 5*, 131–150.

Zhou, Z., McAdam, D. B., & Donnelly, D. R. (2018). Endophenotypes: A conceptual link between anorexia nervosa and autism spectrum disorder. *Research in Developmental Disabilities, 82*, 153-165.

Zipfel, S., Giel, K. E., Bulik, C. M., Hay, P., & Schmidt, U. (2015). Anorexia nervosa: aetiology, assessment, and treatment. *Lancet Psychiatry, 2*(12), 1099-1111.

Rationale for Investigation

Currently, there are no biological markers to identify ASD or risk factors for AN. Previous research has suggested that both disorders share a common social and emotional phenotype. Through research conducted with AN samples it has been reported that a considerable percentage of this group meet the diagnostic criteria for ASD. It has also been reported that individuals with AN not meeting the full criteria for an ASD diagnosis commonly have increased levels of ASD traits as compared to control populations.

The purpose of this dissertation is to further investigate ASD traits and the social and emotional cognitive profiles of young people with AN. This is for the purpose of understanding to what extent commonly reported traits within the literature associated with ASD are present in AN in the early stages of the illness prior to prolonged nutritional deprivation. In consideration of the previously explored literature, this dissertation will seek to inform the evidence base through a systematic review and meta-analysis and an original empirical research paper.

Systematic Review and Meta-Analysis

The principal focus of the systematic review and meta-analysis (Section 2) is to understand the prevalence of ASD traits as measured by one of the most commonly used screening measures of ASD in AN, the Autism Quotient (AQ) and AQ short version the AQ10. The systematic review and meta-analysis was limited to studies conducted with adolescents and young people under the age of 25 with AN to assess the prevalence of ASD traits prior to prolonged periods of nutritional deprivation. Specific objectives of the systematic review and meta-analysis paper were to;

- Systematically review and analyse the levels of self-reported autistic traits among adolescents and young people with AN as measured by the AQ when compared to a healthy control sample.

- Seek to understand if body mass index (BMI), or illness duration, or age act as moderator variables for AQ scores.
- Compare the use of the AQ and AQ10 in studies with adolescents and young people.
- Assess the quality of the studies within the review.

The systematic review and meta-analysis is presented in journal article form tailored to the format of a specific academic journal it is directed towards and follows this section.

Empirical Research

The original empirical research section of the dissertation investigates ASD traits and aspects of social and emotional cognition among young people with AN. This is for the purpose of understanding if commonly reported ASD traits and difficulties with social and emotional cognition within the literature associated with ASD are present in the early stages of AN prior to prolonged nutritional deprivation. Within previous literature, traits associated with ASD have been studied individually among groups with AN. This study is the first to examine ASD traits, theory of mind, alexithymia and empathy simultaneously in an adolescent group with AN.

The study assumes a cross-sectional design where participants consist of two adolescent groups; individuals with AN attending a specialist eating disorder service and a healthy control group recruited from the community through secondary schools. The study collected participant demographic, clinical symptoms and illness-related variables in addition to ASD traits, a theory of mind task, and measures of alexithymia and empathy. The research questions for the empirical research paper sought to;

- Assess for differences in ASD traits as measured by the Autism Quotient between young people with AN and healthy peers.

- Assess for differences in social and emotional functioning as measured by the Reading of the Mind in the Eyes Test, Toronto Alexithymia Scale and the Interpersonal Reactivity Index between young people with AN and healthy peers.
- Investigate any potential relationships between ASD traits and social and emotional cognition within the AN group.
- Investigate the relationships between ASD traits, social and emotional cognition, eating disorder severity and mental health difficulties.

Data were analysed by comparing group means across dependent variables. AN group-specific analyses were conducted using correlational analyses to examine relationships between dependant variables.

The empirical research is presented in two parts. The first of which is the empirical research in a journal article form tailored to the format of a specific academic journal (Section 3). This is followed by a supplementary methodology, results and discussion sections (Section 4).

Section Two: Systematic Review and Meta-Analysis

Using the Autism-Spectrum Quotient to Measure Autistic Traits in Adolescents and Young People with Anorexia Nervosa: A Systematic Review and Meta-Analysis

Target journal: International Journal of Eating Disorders (Appendix 11: author guidelines)

Abstract

Research considering the presence of Autism Spectrum Disorder (ASD) among people with Anorexia Nervosa (AN) has indicated an overrepresentation of the condition among this patient group. Individuals with AN not meeting the full criteria for ASD diagnosis commonly have increased ASD traits relative to control groups. Research with adolescent AN samples has indicated that this group may exhibit reduced levels of ASD traits compared to adults with AN. This systematic review and meta-analysis uses the Autism-Spectrum Quotient (AQ) and abbreviated AQ10 to examine ASD traits in adolescents and young people under 25 with AN. The study was performed following PRISMA guidelines. 2,281 studies were initially retrieved, of which seven studies suitable for inclusion were identified. Results indicate that young people with AN have more ASD traits than healthy peers with a medium effect size observed. This effect size was smaller than that previously reported through meta-analysis. Findings highlight the need for screening to identify people with AN and higher ASD traits who may benefit from adaptions to treatment. Limitations include inconsistencies in the reporting of sample demographics and analysis consisting of a female-only sample. Future longitudinal research is encouraged to examine ASD traits throughout the illness and into recovery.

Introduction

Anorexia Nervosa (AN) is a severe and potentially life-threatening eating disorder. Core diagnostic features of AN include a fear of gaining weight, restriction of energy intake relative to requirements, ongoing behaviour aimed to avoid weight gain, and self-evaluation based on a distorted perception of weight or shape (APA, 2013). The onset of AN is more common among females and typically occurs during adolescence or young adulthood (Volpe et al., 2016). Unlike AN, Autism Spectrum Disorder (ASD) is a lifelong neurodevelopmental condition more typical in males. It is commonly characterised by difficulties in social communication, atypical cognition, sensory sensitivities, and restricted and repetitive patterns of behaviour (APA, 2013; Lai et al., 2014).

Although apparent differences in the main diagnostic criteria and typical profile of people who experience respective conditions, increasingly research has suggested commonalities and comorbidities among individuals with AN and ASD (Courty et al., 2013). Individuals with ASD commonly display intense and restricted interests; within AN this can present as a preoccupation and rigidity around food, calories and losing weight. Although typically more pronounced in ASD, peer and relationship difficulties are common to both conditions (Cresswell et al., 2019; Kinnaird & Tchanturia, 2021; Rhind et al., 2014; Westwood et al., 2016), as are atypical sensory profiles (Ben-Sasson, et al. 2009; Brand-Gothelf et al., 2016). Additional areas of common difficulty among people with AN and ASD include reduced capacity for cognitive flexibility, central coherence, social cognition and emotional processing when compared to healthy control samples (Bentz et al., 2017; Hamatani et al., 2016; Kerr-Gaffney et al., 2020; Mason et al., 2020; Sampaio et al., 2013; Westwood et al., 2017).

When considering comorbidities among the two disorders, individuals with ASD often present with restricted and rigid eating behaviours. Particularly among females, sensory sensitivity to the smell, taste, texture and visual appearance of food and difficulties eating socially have all

been reported (Marı´-Bauset et al., 2014; Spek et al., 2020). Research assessing ASD traits in AN has indicated that many individuals with AN meet the suggested clinical threshold on standardised ASD assessment tools (Autism Diagnostic Observation Schedule, 2nd Edition; ADOS-2). The percentage of participants meeting this threshold across studies is variable. Postorino et al. (2017) reported that 10% of their sample of 30 adolescents with AN met the threshold that indicated the presence of ASD on the ADOS-2. Westwood et al. (2017) also reported that 23.3% of their sample of 60 adult women with AN scored above this threshold on the same measure.

Although indicative of ASD traits in AN samples, this does not necessarily equate to diagnosis. Best practice guidelines require that both a developmental assessment (i.e. Autism Diagnostic Interview-Revised) and an observational assessment be performed to allow for a diagnosis of ASD to be given (NICE, 2017). In the most extensive study to include both observational and developmental assessments conducted by Westwood et al. (2018), 52.5% of the sample met the threshold on the ADOS-2, but only 10% scored above the diagnostic threshold once the developmental assessment was incorporated. This may in part result from parental recognition of ASD in young females or that ASD traits may not be evident in childhood prior to the development of AN. Notwithstanding this, the findings of these studies provide further evidence to suggest that individuals with AN not meeting the full criteria for an ASD diagnosis commonly have sub-threshold ASD traits.

There is uncertainty surrounding the aetiology of ASD traits in AN where a number of potential explanations have been tendered. One such is that ASD traits may represent an innate neurodevelopmental disposition (Treasure & Schmidt, 2013). As ASD is not homogeneous in nature, the concept of a spectrum is used to explain variations in presentations. This ranges from more pronounced difficulties in social skills, communication abilities, personality traits and level of intellectual functioning that merit ASD diagnosis, to less pronounced ASD traits

that do not result in functional impairment or meet the ASD diagnostic threshold. Where these traits are more apparent but do not meet the diagnostic threshold, they are generally considered to constitute the "Broader Autism Phenotype" (Piven & Benjamin, 2002). Despite being more commonly diagnosed among males and ASD being posited as an "extreme form of the male brain" (Baron-Cohen, 2002), more recently a less overt ASD female specific phenotype has also been proposed (Hull et al., 2020). Females with ASD are reported to be more adept at camouflaging social and communication difficulties growing up, while restricted interests and repetitive behaviours are also reported to be less apparent or present as age and gender-typical (Allely, 2019; Hull et al., 2020; Lai et al., 2017). Factors such as these have been associated with missed or later diagnoses among females with ASD (Begeer et al., 2013; Loomes et al., 2017), potentially leading to ASD only being identified when individuals present to services with AN during adolescence or young adulthood.

When considering ASD traits and their role in the development of AN, Baron-Cohen (2010) contends that people with ASD or associated traits are more inclined to "systematise", that is to be drawn towards fixed construct or rule-based systems. Baron-Cohen et al. (2013) suggest that females possessing ASD traits may be drawn towards the "systematised" relationship between food and weight, potentially resulting in an increased risk of females developing AN. This systematised relationship with food may also become more exaggerated and compounded by other traits associated with ASD such as intense preoccupation and cognitive rigidity.

An alternative explanation for this is that people with AN come to develop traits associated with ASD due to the physiological sequelae associated with the nutritional deprivation of the illness (Westwood et al. 2018). Neurophysiological mechanisms linked with the deprivation experienced in AN include reduced grey and white brain matter, with more pronounced reductions associated with low weight and illness duration (Seitz et al., 2018). This has been hypothesised to result in a "neurological scar effect", which has been proposed to explain

various cognitive difficulties associated with AN (Saure et al., 2020). Sedgewick et al. (2019) offer some evidence for the impact of acute starvation on ASD traits through their study where they examined differences in the scores on an ASD diagnostic instrument among women experiencing AN, individuals recovered from AN and healthy controls. Findings indicated that more individuals in the AN group and recovered individuals scored above the ASD diagnostic cut-off than healthy controls. Interestingly, recovered individuals represented a midpoint between the scores of those with and without AN, thus indicating a potential reduction in ASD traits with recovery.

Similar findings have also been reported through ASD-related self-report instruments. Karjalainen et al. (2017) reported a reduction in ASD traits in an AN group at a one year follow up where weight restoration had been observed. Additionally, lower ASD traits as measured by self-report measures have been reported when comparing acutely unwell groups with recovered groups (Kerr-Gaffney et al., 2020; Leslie et al., 2020). Although the differences between acutely unwell groups and recovered groups were not statistically significant, they are suggestive of change in ASD traits with weight restoration. A reduction in other difficulties associated with ASD have also been reported among recovered AN cohorts in other areas such as Theory of Mind (Bora & Köse, 2016), certain cognitive domains (Tomba et al., 2019), and emotional cognition (Gramaglia et al., 2020; Kerr-Gaffney et al., 2020).

An additional explanation combines both the neurodevelopmental and physiological starvation hypotheses and proposes that pre-existing ASD traits become exacerbated due to periods of extended nutritional deprivation (Westwood et al., 2018). Further to this, as ASD traits in AN are associated with a longer duration of illness and less responsive to intervention (Saure et al., 2020), ASD traits may be associated with AN persevering into adulthood. Given that the onset of the illness is typically during adolescence (Volpe et al., 2016), extended periods of starvation and the associated neurophysiological consequences may present as increased ASD traits

reported among adult samples. Although not a direct comparison, this contention is supported through research with adolescents with AN where ASD diagnoses and associated traits are reported to be less common than in adults with AN (Pooni et al., 2012; Postorino et al., 2017).

The uncertainty surrounding the overlap in trait profiles has led to researchers examining the prevalence of ASD traits in AN. One of the most common instruments used is the Autism Quotient (AQ), a self-report ASD screening instrument utilised through research among the general population and in studies considering ASD traits among people with various psychiatric diagnoses (Allison et al., 2012; Cath et al., 2008; Greenber et al., 2018; Wouters & Spekb, 2011).

The AQ is a 50-item multiple-response questionnaire with five subscales: Social Skills, Attention Switching, Attention to Detail, Communication and Imagination. Research considering the utility of the AQ has indicated that it has adequate sensitivity and specificity to distinguish people with ASD, where a score of 32 or above out of a possible 50 is suggestive of ASD, scores between 23-28 are consistent with the Broader Autism Phenotype (Baron-Cohen et al., 2001). The AQ has been reported to demonstrate moderate to good internal consistency, and satisfactory test-retest reliability with AQ sum scores normally distributed in the general population. However, the AQ subscales have not been replicated in subsequent factor-analytic studies (Kloosterman et al., 2011; Stewart & Austin, 2009). There have also been several variations of the AQ (i.e. child-specific, parent-report) and the development of a shortened version; the AQ10 which is reported to have similar sensitivity and specificity to the full version (Allison et al., 2012; Booth et al., 2013).

As one of the most widely used screening tools, the AQ has also been commonly utilised to assess traits associated with ASD among AN samples. Westwood et al. (2016) conducted a systematic review and meta-analysis of seven studies comparing profiles of AN cohorts to

healthy control groups on the AQ. Of the seven studies considered within the analysis, one was conducted with adolescents specifically, two collected data across children/adolescents and adult samples. The remaining four studies collected data with adults specifically. Meta-analyses were conducted for the entire samples, in addition to specific analyses for adults and children/adolescents respectively. Within the overall analysis, results indicated a large effect size between AN and healthy control groups on the AQ with the AN group scoring more highly, indicating increased ASD traits. However, there was substantial heterogeneity between studies reported. The adult-specific analysis results indicated a large effect size with heterogeneity much reduced through the exclusion of child/adolescent studies. It is unclear why the authors included the 16-18 age cohort from the Baron-Cohen et al. (2013) study within their adult analysis.

In the meta-analysis of child/adolescent data, Westwood et al. (2016) compared 90 children/adolescents with AN to a healthy control sample of 625 children/adolescents. Results indicated significantly more ASD traits among the AN group with a large effect size, however substantial heterogeneity was reported. For the analyses conducted with children/adolescents, one study used the AQ10 (Lang et al., 2015) while another utilised the AQ Parent Report with participants under sixteen (Baron-Cohen et al., 2013), with just one study using the full AQ (Calderoni et al., 2015). It is likely that differences between measures contributed to observed heterogeneity. Specifically, the AQ Parent Report measures which were the most highly weighted of all studies considered within the analysis (Baron-Cohen et al. 2013). Prior research has recommended caution when engaging in this practice as there is a risk of a discrepancy between parental and adolescent self-reports on the AQ among young people with ASD (Johnson et al., 2009). It is possible that this analytic choice may have skewed results within the analysis and inflated the effect size reported. Additionally, there were a relatively small

number of studies included, further reducing the confidence in the child/adolescent analysis results.

Notwithstanding methodological issues, the results of the study provided interesting findings whereby people with AN reported more ASD traits than healthy controls on the AQ and its variations. Additionally, effect sizes among the children and adolescent sample were smaller than adult samples which provides evidence to suggest that young people with AN present with fewer ASD traits than older cohorts.

Currently, there is a lack of consensus about whether ASD type difficulties in AN exist prior to the onset of the AN, whether they are a result of starvation, enduring illness, or that they are pre-existing and become exacerbated during acute stages of the illness (Westwood, et al., 2018). Research with acutely unwell adult AN samples has reported that this group exhibit a higher prevalence of ASD traits than healthy control samples, while these traits appear to be reduced within recovered groups. Additionally, evidence regarding the prevalence of these traits in groups with recent onset or children and adolescents remains unclear with difficulties either less pronounced or not apparent.

Present Study

The uncertainty surrounding the aetiology of AN is partly due to a paucity of research considering different stages of the illness. Understanding the prevalence of ASD traits in children/adolescents or groups with recent onset is the principal focus of the current review and analysis. As stated, ASD traits are associated with a more enduring course of illness and a poorer response to treatment. Considering a younger cohort specifically on the AQ will allow for comparison with adult AN samples within the literature. This will help inform the evidence base as to whether these traits are present within the early stages of the illness prior to prolonged periods of nutritional deprivation. As one of the most widely used measures, the present study

will examine self-reported traits as measured by the AQ or AQ10 when compared to healthy control groups. As the mean age of onset of AN is reported to be 18 and prolonged duration considered to be seven years or above (Broomfield, et al., 2017; Volpe, et al., 2016), the parameters for inclusion will be limited to cohorts aged 25 and under as they are less likely to have a prolonged duration of the illness.

The previous review conducted by Westwood et al. (2016) was conducted in 2015. Since then a number of additional studies have been published considering the presence of ASD traits in AN with adolescents and young adults. Increasing the number of participants included within the analysis will facilitate more robust findings and allow for more confidence in the interpretation of results. The present review will also seek to overcome some of the methodological limitations of Westwood et al.'s (2016) analysis. This will involve the exclusion of parent report measures which due to discrepancies between self and parent reports has been advised against (Johnson et al., 2009). This practice also appeared to be associated with high levels of heterogeneity within the previous analysis. Additionally, the aforementioned analysis did not evaluate the methodological quality of studies included which reduces the confidence with which findings can be interpreted.

The objectives of the current study are to;

1. Systematically review and analyse the levels of self-reported autistic traits among adolescents and young people with AN as measured by the AQ or AQ10 when compared to a healthy control sample.

2. Seek to understand if body mass index (BMI), or illness duration, or age act as moderator variables for AQ scores.

3. Compare the use of the AQ and AQ10 in studies with adolescents and young people.

4. Assess the quality of the studies within the review to assess the degree to which we can be confident in these findings.

Method

Protocol

The study was performed in accordance with the "Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)" protocol (Moher et al., 2009). Eligibility criteria, search strategy, collection of data, and evaluation of limitations and biases were predefined and performed according to these guidelines. The review and associated protocol was also registered with PROSPERO (CRD42020215501).

Eligibility Criteria

Studies were required to be original research articles where both a AN and healthy control group were compared using the AQ or AQ10. Studies using the AQ adolescent/child were excluded as they are not self-report. Participants were required to have a diagnosis of AN and be no older than 25. There was no restriction surrounding the gender or settings in which the AQ was administered. Other eligibility criteria include being published in a peer-reviewed journal and being available in English.

Data Sources and Search Strategy

Studies were identified via electronic search in the following databases; EBSCO, Scopus, Web of Science, PubMed and ProQuest. Searches were limited to 2001 onwards, as this was when the AQ was first published. The upward threshold was October 2020. Search terms were tailored to specific databases and contained the following words and their variants; anorexia, eating disorder, autism spectrum disorder, Asperger, social cognition, autism quotient. Specific search strategies for each database can be seen in Appendix 1. The reference sections of relevant studies, in addition to the previous review of Westwood et al., (2016) were examined to identify any further eligible studies.

Study Selection

The literature search resulted in 2,280 returns. One additional record was sourced through data provided in the previous analysis of Westwood et al. (2016). After duplicates were removed, 1,492 records were screened based on titles and abstracts. Where it was unclear whether inclusion criteria was met the full-text screening was carried out for 103 articles. An interrater analysis was performed for approximately one-third of articles (n=35) included in the full-text review. Through this analysis there was 100% agreement on the inclusion of studies. Common reasons for exclusion included the sample being over the age of 25, absence of a healthy comparison group and not using the AQ. The final sample consisted of 7 studies. A flowchart of the study selection process is presented in Figure 1.

Data Extraction

Data was collected by reviewing and extracting relevant information for studies which was input into a prepopulated spreadsheet. The following data was extracted; AN and healthy control sample size, age (mean and standard deviation), gender, ethnicity, AQ measure used and mean total scores, BMI, diagnostic category and criteria used, illness duration (mean and standard deviation), use of medication among participants, the presence of other mental health difficulties and country of study. Calderoni et al., (2015) was the only study to provide subscale scores for the AQ, and therefore a subscale analysis could not be performed. In the study of Lang et al. (2015), adult and child data were pooled, however the authors provided Westwood et al. (2016) with the child data separately for their previous review from where it was extracted.

Synthesis of Data

Quantitative analyses were conducted using Review Manager 5 (2020). Limited homogeneity was expected due to similarities across the studies such as a comparable and limited age range, similar BMIs and duration of illnesses. Previous research has also indicated that the AQ and

AQ10 are comparable and have similar sensitivity and specificity with regard to ASD traits (Allison et al., 2012; Booth et al., 2013). With this considered, meta-analyses were conducted using a fixed-effects model and standard mean difference calculated. Cohen's *d* was used to estimate the effect size and reported with a 95% confidence interval. The following interpretations of effect sizes were used; $\geq 0.20 < 0.50$ considered small, $0.50 \leq .80$ medium and $0.80 \leq 1.30$ deemed large (Cohen, 1988). Positive effect size indicates that the AN group had higher scores on the AQ or AQ10 than healthy controls.

Heterogeneity Analysis

Between-study heterogeneity was measured using I^2 based on Cochran's Q test (Higgins et al., 2003). I^2 scores range between 0-100% with 0 indicating no heterogeneity and 100% representing considerable heterogeneity. I^2 statistics between 0 to 40% are considered low and might not be important; 30% to 60% is considered moderate; 50% to 90% may represent substantial heterogeneity, with 75% to 100% deemed high (Deeks et al., 2020).

Quality Assessment and Risk of Bias

The quality of studies was assessed using the Newcastle- Ottawa Scale for case-control studies (Wells et al., 2020). This instrument assesses the quality of studies with regard to participant selection (four criteria), the study of cases and controls (two criteria), and assessment of the outcome (three criteria). A study can obtain one star for each assessed criterion, with a maximum of nine stars. The quality assessment was conducted by authors SM and CR separately, following which areas of disagreement were discussed and consensus reached. To evaluate for bias, further analyses were conducted through the JASP (2020) software package. Funnel plots were visually inspected for signs of asymmetry with additional analyses conducted to assess for publication bias.

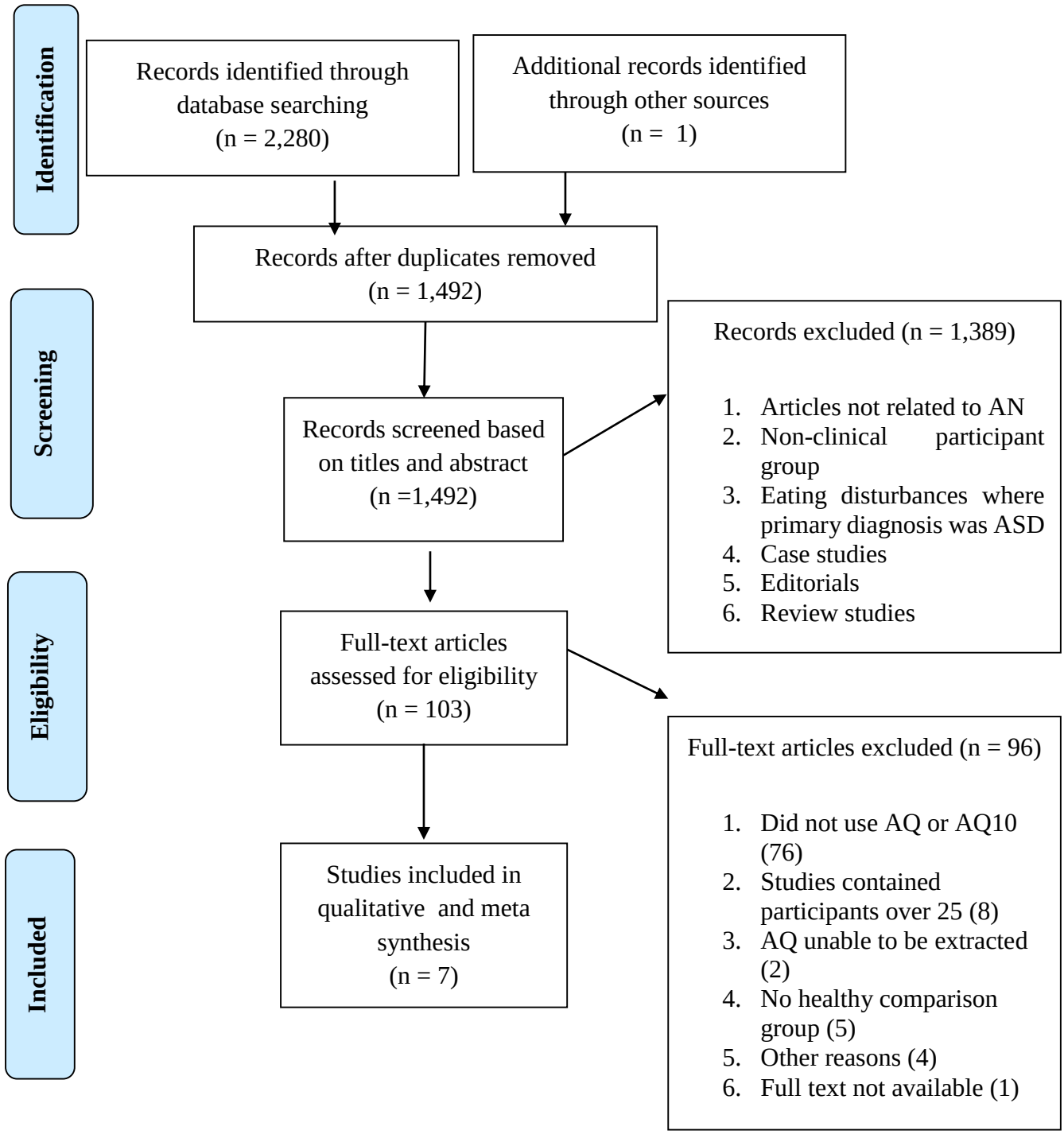


Figure 1. *Study selection process*

Table 1: *Study characteristics*

Author	Participants	Age (SD)	Matched	AN type	BMI (SD) / W4H %	Additional Diagnosis	Mean Duration of illness (SD)	Measure	Mean (SD)	AN Group Medication	Country
Baron-Cohen et al. (2013)	AN: 42 HC:1038	16-18	Gender	AN unspecified - DSM-IV	NR	NR	NR	AQ	AN: 21 (6.8) HC: 15.5 (5.6)	NR	UK
Björnsdotter et al. (2019)	AN: 25 HC:25	AN: 20.32 (2.23) HC: 21.28 (2.11)	Age Gender	AN-R: 21 AN-BP: 4 - DSM-IV	AN: 16.28 (0.93) HC: 21.13 (2.27)	Significantly higher scores on Beck Depression Inventory	4.14 (3.54)	AQ	AN: 16.60 (6.73) HC:11.64 (6.82)	Fluoxetine (*n* = 6), Sertraline (*n* = 4), Olanzapine (*n* = 2), Quetiapine (*n* = 1), Venflaxine (*n* = 1), Propiomazine (*n* = 4), Other (*n*=2)	Sweden
Calderoni et al. (2015)	AN: 25 HC: 170	AN: 14.34 (1.85) HC: 15.01 (2.61)	Age Gender Education	AN-R-DSM-IV-TR	AN: 14.63 (1.90) HC: 20.60 (3.22)	Anxiety and/or depression (n=21), Personality disorder (n=2) Scored significantly higher on Youth Self Report for total problems	NR	AQ	AN: 21.04 (7.52) HC: 17.46 (5.5)	17 participants were prescribed selective serotonin reuptake inhibitors and/or atypical antipsychotics and/or a mood stabiliser	Italy

Karjalainen et al. (2019)	AN: 34 HC:14	AN: 19.6 (2.23) HC: 18 (2.47)	Gender	AN unspecified: 34 Atypical AN: 2 - DSM-5	AN: 16.1 (0.89) HC: 21.3 (2.18)	NR	2.73 (3.02)	AQ	AN: 17.6 (8.2) HC: 10.71 (4.71)	NR	Sweden
Lang et al. (2015)	*AN: 41 HC: 43	*AN: 15.07 (1.81) HC: 15.11 (1.94)	*Gender Age	AN unspecified - DSM-5	AN %W4H: 80.65 (6.69) HC %W4H: 100.62 (9.95)	Increased levels of anxiety and depression reported through the Hospital Anxiety and Depression Scale	*1.70 (1.18)	AQ10	*AN: 3.88 (2.12) HC: 2.67 (1.28)	NR	UK
Leslie et al. (2020)	AN: 67 HC: 70	AN: 18.70 (2.78) HC: 19.64 (3.30)	Gender Age IQ	AN unspecified - DSM-5	AN: 16.61 (1.41) HC: 22.82 (3.31)	NR	3.18 (2.56)	AQ10	AN: 3.98 (2.41) HC: 2.31 (1.72)	AN: Anti-depressants (n=17), Antipsychotics (n=3), Anti-depressants and Antipsychotics (n=5), Anti-depressants and benzodiazepine (n=1) HC: Anti-depressants (n=2), Stimulant medication (n=1)	UK

Tonaccai et al. (2019)	AN: 19 HC:19	AN: 15.4 (2.5) HC: 14.7 (2.9)	Gender Age	AN-R DSM-5	-	AN: 17.1 (1.7) HC: 20.3 (2.6)	Scored significantly higher on Youth Self Report and Child Behaviour Checklist	1.3 (1.4)	AQ	AN: 19.9 (7.7) HC: 15.1 (7.1)	Anti-depressants/ atypical neuroleptics (n=7)	Italy

Abbreviations: AN – Anorexia nervosa, AN-R - Anorexia nervosa restricting type, AN-BP - Anorexia nervosa binge-purge type, BMI – Body mass index, HC – Healthy control, NR – Not reported, W4H% - Percentage weight for height

*Data extracted from previous analysis of Westwood et al., (2016)

Results

Study Characteristics

Seven studies were identified as suitable for inclusion within the current review. The final list of studies included in the analysis and associated characteristics are presented in Table 1. Of the seven studies, two used the AQ10 (Lang et al., 2015; Leslie et al., 2020), with the remaining studies using the full-length AQ. Participants across studies were all female and ranged in age from 11 to 25. Ethnicity or race was not reported in any study. All studies with the exception of Baron-Cohen et al. (2013) reported how underweight the AN cohort were. This ranged from a mean BMI of 14.63 (Calderoni et al., 2015) to 17.1 (Tonacci et al., 2019). Lang and colleagues (2015) were the only authors to report percentage weight for height. The mean BMI and percentage weight for height for healthy control groups were all within normal ranges. Five studies provided illness duration information where 4.14 years was the longest (Björnsdotter et al., 2019), and 1.3 years the shortest (Tonacci et al., 2019). Baron-Cohen et al. (2013) and Calderoni et al. (2015) did not provide duration related information.

There was a large amount of variability in sample size across studies. The largest sample was reported by Leslie et al. (2020) with 67 matched participants, and 19 the smallest as reported by Tonaccai et al. (2019). There was also a disparity in the size between AN and healthy control samples, particularly Baron-Cohen et al. (2013) and Calderoni et al. (2015) where the number of healthy control participants considerably outnumbered AN participants. The converse of this was reported for Karjalainen et al. (2019) where only 14 healthy control participants completed the AQ, in comparison to 34 of the AN cohort with no explanation provided for this. The remaining studies had comparable numbers across AN and healthy control groups. All studies matched their control group for gender. All except two matched for age (Baron-Cohen et al., 2013; Karjalainen et al., 2019). Calderoni et al. (2015) matched for level of education, and

Leslie et al., (2020) for IQ. Three studies did not adequately describe their screening process for the inclusion of control participants (Calderoni et al., 2015; Karjalainen et al., 2019; Tonaccai et al., 2019)

Baron-Cohen et al. (2013) and Björnsdotter et al. (2019) used DSM-IV criteria, Calderoni et al. (2015) utilised DSM-IV-TR diagnostic criteria. The remaining studies employed DSM-5 criteria (Karjalainen et al., 2019; Lang et al., 2015; Leslie et al., 2020; Tonacci et al., 2019). Four studies did not differentiate between AN subtypes (Baron-Cohen et al., 2013; Lang et al., 2015; Leslie et al., 2020); however one study where AN unspecified was reported included two participants with Atypical AN (Karjalainen et al., 2019). Two studies were solely made up of participants with AN restricting subtype (Calderoni et al., 2015; Tonacci et al., 2019). The Björnsdotter et al. (2018) sample was also predominately made up of individuals with AN restricting subtype with the exception of two participants with AN binge/purge subtype.

Calderoni et al. (2015) was the only study to provide subscale scores for the AQ. Three studies did not provide information on comorbid difficulties (Baron-Cohen et al., 2013; Karjalainen et al., 2019; Leslie et al., 2020). Calderoni et al. (2015) was the only study to provide additional diagnostic information where a large proportion of the sample were reported to have diagnoses of anxiety and/or depression. The remaining studies provided additional information on the mental health of participants through specific measures such as the Beck Depression Inventory (Björnsdotter et al., 2018), the Hospital Depression and Anxiety Scale (Lang et al., 2015), and Youth Self Report (Calderoni et al., 2015; Tonaccai et al., 2019). Across all of these measures participants with AN were reported to have significantly higher scores than their healthy control counterparts. Four studies provided information on the pharmacological intervention being received by participants, the majority of which were prescribed antidepressants (Björnsdotter et al., 2018; Calderoni et al., 2015; Leslie et al., 2020; Tonaccai et al., 2019).

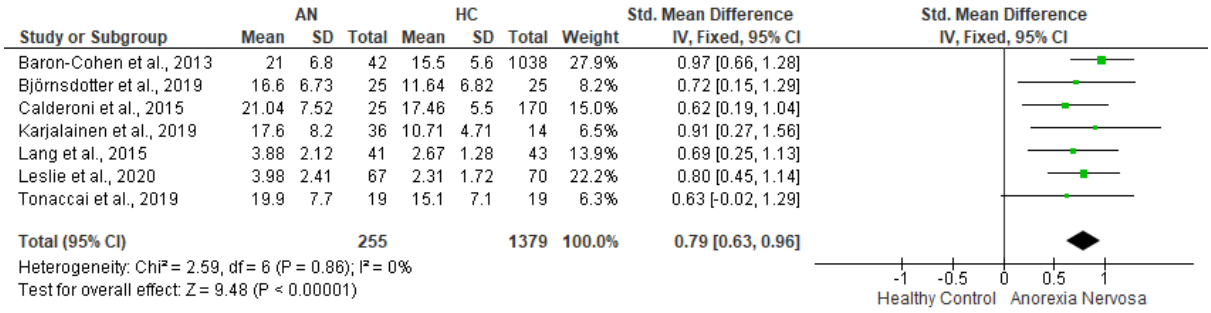


Figure 2. *Forest plot*

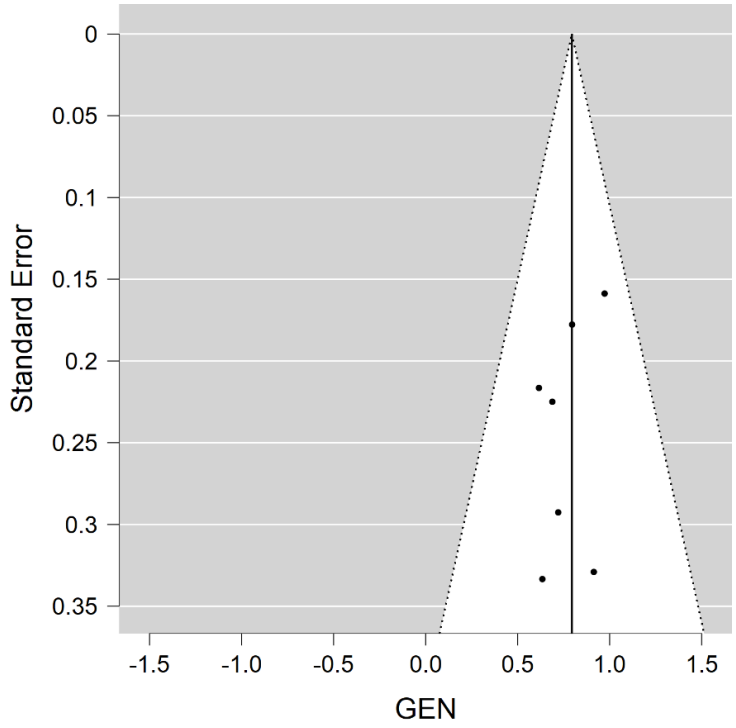


Figure 3. *Funnel plot*

The AQ was administered in clinics in four of the studies (Calderoni et al., 2015; Karjalainen et al., 2019; Lang et al., 2015; Leslie et al., 2020), one in the community (Baron-Cohen et al., 2013), the two remaining studies did not describe where the measure was completed (Björnsdotter, et al., 2018; Tonaccai et al., 2019). Three studies were conducted in the UK (Baron-Cohen et al., 2013; Lang et al., 2015; Leslie et al., 2020), two in Italy (Calderoni et al.,

2015; Tonaccai et al., 2019), and two in Sweden (Björnsdotter et al., 2019; Karjalainen et al., 2019).

Synthesized Findings

Using a fixed-effects model the meta-analysis indicated a significant difference between AN and healthy control (N=1,634, AN=255, healthy control =1,379) group mean scores (d= 0.79; 95% CI: 0.63, .96, Z = 9.48, p = <0.00001). The forest plot for the meta-analysis is presented in Figure 2. Heterogeneity between studies in the analysis was low (I^2 =*0%*). As a result of a number of studies providing insufficient information a meta-regression analysis to examine the impact of moderator variables was not conducted.

Quality Assessment and Risk of Bias

When assessing the quality of studies using the Newcastle-Ottawa Scale for case-control studies, one study was awarded six stars, five studies were awarded seven stars and one study was awarded eight out of a possible 9 (see Appendix 2). Good symmetry in the funnel plot was observed (see Figure. 3), indicating no relationship between effect and study size. Egger's test (1997) was also conducted to statistically assess for publication bias where none was indicated (p= 0.442).

Discussion

Summary of Main Findings

The purpose of this study was to systematically review and analyse levels of self-reported ASD traits among adolescents and young people with AN as measured by the AQ when compared to healthy control samples. Results of the meta-analysis indicate that adolescents with AN endorse significantly more ASD traits as measured by the AQ or AQ10 than healthy control samples, this is with a moderate effect size.

It also sought to understand if BMI, illness duration or having additional mental health difficulties moderated AQ scores. Additional aims of the study included comparing the use of the AQ and AQ10 and assessing the quality of the studies included in the review. Due to inconsistencies in reporting data on BMI, specific ages, additional diagnosis and illness duration, further analyses to explore the impact of these factors on AQ scores were not possible.

The sample consisted entirely of females, thus limiting the generalisability of findings to males with AN. The full AQ was utilised in the majority of studies identified within the review. Where the AQ10 was used it appeared to have similar results as the full AQ. It should however be considered that the AQ was not designed for use with individuals under the age of sixteen as was the case for a number of the studies included, this may have potentially resulted in the under reporting of ASD traits.

No evidence of bias was apparent through statistical analysis and the quality of studies was reasonable as measured by the Newcastle-Ottawa Scale for Case–Control studies (Wells et al., 2020). However, some studies omitted important information. There was minimal heterogeneity between studies observed with Tonaccai et al. (2019), the only study to report results that were not consistent with the main findings. Factors such as a small sample size, in

addition to the BMI of the sample being considered in the mild range (APA, 2013), may have had implications on findings when considering this study specifically.

Although the impact of additional mental health difficulties could not be statistically examined, a number of individual studies reported comorbid diagnoses and additional mental health difficulties reported through self-report measures. Calderoni et al. (2015) highlight the potential significance of this through their study where high scores on the AQ among individuals with AN were associated with high internalising symptoms. Given that many people with AN experience comorbid anxiety and depression (Bühren et al., 2014), Calderoni et al. (2015) propose that due to internalising symptoms, the presentation of ASD traits may be overestimated. However, it is also possible that the presence of ASD or traits may lead to an increased risk of experiencing internalising difficulties themselves (Lai et al., 2019).

Findings are in line with the overall results of the prior Westwood et al. (2016) analysis. However, when considering the child sample analysis specifically, the difference observed through this analysis (*d*= 0.79*)* is not as substantial as that previously reported (*d*=0.96). Possible explanations for this include an increased sample size in the present analysis leading to more robust findings and the exclusion of parental reports which can be inflated in comparison to self-reported measures. Within Westwood et al.'s (2016) analysis there was a limited difference between the reported effect sizes of the child/adolescent and adult analyses. When considering this in contrast to the present results, the effect size for adolescents and young people was considerably lower than that reported for Westwood et al. (2016) adult sample specifically (*d*=1.10). This may suggest the presence of an ASD phenotype that is present within the early stages of the illness. However, conclusions cannot be drawn as to whether these are pre-existing neurodevelopmental traits or as a result of acute starvation.

When contrasted with previous research (Westwood et al., 2016), the present results indicate that younger cohorts self-report fewer ASD traits than adult samples. When considering neurophysiological mechanisms linked with nutritional deprivation, adolescents are reported to experience a larger reduction in cortical matter than adults (Seitz et al., 2018), but experience fewer impairments with regard to cognitive functioning (Telléus et al., 2015). Notwithstanding the neurophysiological sequelae associated with AN in adolescents the present findings indicate that young people with AN experience fewer ASD type traits than adults. These findings supplement the growing evidence base indicating that ASD traits may be associated with the longevity of nutritional deprivation experienced by older cohorts or are potentially protected against through increased plasticity.

More significant ASD traits in adulthood may also be explained through these characteristics themselves being associated with a more severe clinical presentation, poorer response to treatment and resultant longer duration of illness (Nielsen et al., 2015; Saure et al., 2020; Tchanturia et al., 2019). Traits such as cognitive inflexibility and weak central coherence have been suggested as causal factors for this increased illness duration (Saure et al., 2020). With this considered, it is likely that they are also maintaining factors and may explain individuals with higher ASD traits responding less favourably to treatment when compared to peers with lower ASD traits. As a result, this group with higher ASD traits eating difficulties likely persist beyond adolescence and young adulthood. This may potentially lead to an overrepresentation of adults with AN with higher ASD traits reflected in the evidence base.

Additionally, they are more likely to experience the neurological scar effect associated with prolonged nutritional deprivation which may perpetuate or compound existing ASD traits. As a result, it can be hypothesised that there is an overrepresentation of adults with higher ASD traits when compared to younger cohorts. This may serve as another potential explanation for

the difference observed between the present findings and the Westwood et al., (2016) adult analysis. Although there are several potential explanations for the difference in the level of ASD traits between the present results and previously reported adult analyses, it is likely that this disparity between adolescents/young people and adults is a result of a combination of these theories.

Practical Implications

The findings from the present study have practical implications for the future service provision and treatment of AN in young people. As ASD and associated traits have been linked with a more chronic course of illness, services should seek to screen for individuals high in ASD traits. Screening may also help identify individuals with undiagnosed ASD which may act as a complicating factor for treatment. Adaptions to therapeutic approaches are recommended for individuals with AN and ASD (Tchanturia, 2021), through differentiating between patients with high or low ASD traits to facilitate tailoring of interventions for these groups. Current results suggest that adolescents and young people with AN present with a cognitive style that is associated with difficulties in social skills, attention switching, attention to detail, communication and imagination. Existing therapeutic interventions may benefit from being adapted to work with, or around these issues which may form barriers to treatment for this patient group.

Strengths and Limitations

The present study overcomes some of the limitations of the previous analysis of Westwood et al. (2016). The inclusion of additional studies, increased sample size, analysis being limited to self-report data only and quality evaluation of included studies are all strengths of the present study. Despite these strengths, there are also a number of limitations. Some studies did not provide important information such as BMI, AN subtype or duration of illness which would

have allowed for further analysis. Although females represent a large proportion of individuals who experience AN, the absence of males with AN within the analysis is a limitation. Additionally, the omission of sample information in included studies did not allow for further statistical analysis to allow for the identification of potential moderator variables.

In light of these limitations, future longitudinal research with AN cohorts is encouraged in order to develop an understanding as to what extent these traits are pre-existing and whether they fluctuate over the course of the illness according to duration and into recovery. Future research should also seek to understand to what extent BMI and AN subtype impact ASD traits in AN. Further research is also required to understand the impact additional mental health difficulties may have on the representation of ASD traits in AN. Currently, there is a dearth of research considering the presence of ASD traits in males with AN. To understand if this presentation is specific to females with AN further, research needs to be conducted with males to allow for comparison.

Conclusion

Results indicate that children and young people with AN present with significantly more ASD type characteristics in comparison to their peers as measured by the AQ. This suggests that characteristics associated with ASD are present prior to prolonged periods of nutritional deprivation, however this is not to the extent previously reported. Comparison with adult populations suggest that there are more ASD type characteristics among adults with AN, potentially as a result of a neurological scar effect associated with extended periods of nutritional deprivation. Alternately, individuals high in ASD type characteristics respond less favourably to treatment and therefore are more likely to be overrepresented within the adult literature. A combination of these two theories may also account for this observation, however further longitudinal research is required in order allow for conclusions to be established.

References

Allely, C. (2019). Exploring the female autism phenotype of repetitive behaviours and restricted interests (RBRIs): a systematic PRISMA review. *Advances in Autism, 5*(3), 171-186. doi:10.1108/AIA-09-2018-0030

Allison, C., Auyeung, B., & Baron-Cohen, S. (2012). Toward Brief "Red Flags" for Autism Screening: The Short Autism Spectrum Quotient and the Short Quantitative Checklist in 1,000 Cases and 3,000 Controls. *Journal of the American Academy of Child and Adolescent Psychiatry, 51*(2), 202-212.

APA. (2013). *Diagnostic and statistical manual of mental disorders.* Washington DC: American Psychiatric Publishing.

Barnett, A., Edwards, K., Harper, R., Evans, E., Alexander, D., Choudhary, M., & Richards, G. (2020, August). Eating is Moderated by Sex/Gender and Independent of Anxiety and Depression. *Journal of Autism and Developmental Disorders*. doi:https://doi.org/10.1007/s10803-020-04669-z

Baron-Cohen, S. (2002). The extreme male brain theory of autism . *Trends in Cognitive Sciences, 6*(6), 248-254.

Baron-Cohen, S. (2010). Empathizing, systemizing, and the extreme male brain theory of autism. *Progress in Brain Research, 186*, 167-175.

Baron-Cohen, S., Jaffa, T., Davies, S., Auyeung, B., Allison, C., & Wheelwright, S. (2013). Do girls with anorexia nervosa have elevated autistic traits? *Molecular Autism, 4*(24). doi:https://doi.org/10.1186/2040-2392-4-24

Begeer, S., Mandell, D., Venderbosch, B. W.-H., Rem, D., Stekelenburg, F., & Koot, H. M. (2013, May). Sex Differences in the Timing of Identification Among Children and Adults with Autism Spectrum Disorders. *Journal of Autism and Developmental Disorders, 43,* 1151–1156. doi:https://doi.org/10.1007/s10803-012-1656-z

Ben-Sasson, Hen, L., Fluss, R., Cermak, S. A., Engel-Yeger, B., & Gal, E. (2009). A meta-analysis of sensory modulation symptoms in individuals with autism spectrum disorders Ayelet. *Journal of Autism and Developmental disorders, 39*(1), 1-11. doi:10.1007/s10803-008-0593-3

Bentz, M., Jepsen, J. R., Pedersen, T., Bulik, C. M., Pedersen, L., Pagsberg, A. K., & Plessen, K. J. (2017). Impairment of Social Function in Young Females With Recent-Onset Anorexia Nervosa and Recovered Individuals. *Journal of Adolescent Health, 60*(1), 23-32.

Björnsdotter, M., Davidovic, M., Karjalainen, L., Starck, G., Olausson, H., & Wentz, E. (2018). Grey matter correlates of autistic traits in women with anorexia nervosa. *Journal of Psychiatry and Neuroscience, 43*(2), 79–86.

Booth, T., Murray, A. L., McKenzie, K., Kuenssberg, R., O'Donnell, M., & Burnett, H. (2013). Brief Report: An Evaluation of the AQ-10 as a Brief Screening Instrument for ASD in Adults. *Journal of Autism and Developmental Disorders, 43,* 2997–3000.

Bora, E., & Köse, S. (2016). Meta-analysis of theory of mind in anorexia nervosa and bulimia nervosa: A specific İmpairment of cognitive perspective taking in anorexia nervosa? *International Journal of Eating Disorders, 49*(8), 739-740.

Brand-Gothelf, A., Parush, S., Eitan, Y., Admoni, S., Gur, E., & Stein, D. (2016). Sensory modulation disorder symptoms in anorexia nervosa and bulimia nervosa: A pilot

study. *The International Journal of Eating Disorders, 49*(1), 59-68. doi:10.1002/eat.22460

Broomfield, C., Stedal, K., Touyz, S., & Rhodes, P. (2017). Labeling and defining severe and enduring anorexia nervosa: A systematic review and critical analysis. *International Journal of Eating Disorders, 50*(6), 611-623.

Bühren, K., Schwarte, R., Fluck, F., Timmesfeld, N., Krei, M., Egberts, K., . . . Herpertz-Dahlmann, B. (2014). Comorbid Psychiatric Disorders in Female Adolescents with First Onset Anorexia Nervosa. *European Eating Disorders Review, 22*, 39–44.

Calderoni, S., Fantozzi, P., Balboni, G., Pagni, V., Franzoni, E., Apicella, F., ... & Muratori, F. (2015). The impact of internalizing symptoms on autistic traits in adolescents with restrictive anorexia nervosa. *Neuropsychiatric Disease and Treatment, 11*, 75.

Cath, D., Ran, N., Smit, J., Balkom, A. v., & Comijs, H. (2008). Symptom Overlap between Autism Spectrum Disorder, Generalized Social Anxiety Disorder and Obsessive-Compulsive Disorder in Adults: A Preliminary Case-Controlled Study. *Psychopathology, 41*, 101–110.

Christensen, S. S., Bentz, M., Clemmensen, L., Strandberg-Larsen, K., & Olsen, E. M. (2019). Disordered eating behaviours and autistic traits—Are there any associations in nonclinical populations? A systematic review. *European Eating Disorders Review, 27*(1), 8-23. doi: https://doi.org/10.1002/erv.2627

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences.* London: Laurence Erlbaum Associates.

Courty, A., Maria, A. S., Lalanne, C., Ringuenet, D., Vindreau, C., Chevallier, C., . . . Berthoz, S. (2013). Levels of autistic traits in anorexia nervosa: a comparative psychometric study. *BMC Psychiatry, 13*(1). doi:https://doi.org/10.1186/1471-244X-13-222

Cresswell, L., Hinch, R., & Cage, E. (2019). The experiences of peer relationships amongst autistic adolescents: A systematic review of the qualitative evidence. *Research in Autism Spectrum Disorders*, 45-60. doi:doi.org/10.1016/j.rasd.2019.01.003

Deeks, o. J., Higgins, J. P., & Altman, D. G. (2020). Chapter 10: Analysing data and undertaking meta-analyses. In J. Higgins, J. Thomas, J. Chandler, M. Cumpston, T. Li, M. Page, & V. Welch (Eds.), *Cochrane handbook for systematic reviews of interventions* (Version 6.1 ed.). John Wiley & Sons.

Egger, M., Smith, G. D., Schneider, M., & Minder, C. (1997). Bias in meta-analysis detected by a simple graphical test. *British Medical Journal, 315*(7109), 629-634.

Gramaglia, C., Gambaro, E., & Zeppegno, P. (2020). Alexithymia and Treatment Outcome in Anorexia Nervosa: A Scoping Review of the Literature. *Frontiers in Psychiatry, 10*(991). doi:10.3389/fpsyt.2019.00991

Greenberg, D. M., Warrier, V., Allison, C., & Baron-Cohen, S. (2018). Testing the Empathizing–Systemizing theory of sex differences and the Extreme Male Brain theory of autism in half a million people. *Proceedings of the National Academy of Sciences of the United States of America, 115*(48), 12152–12157.

Hamatani, S., Tomotake, M., Takeda, T., Kameoka, N., Kawabata, M., Kubo, H., . . . Ohmori, T. (2016). Impaired social cognition in anorexia nervosa patients. *Neuropsychiatric Disease and Treatment, 5*(12), 2527–2531.

Higgins, J., Thompson, S., Deeks, J., & Altman, D. G. (2003). Measuring inconsistency in meta-analyses. *British Medical Journa;, 327,* 557-560.

Hull, L., Petrides, K., & Mandy, W. (2020). The Female Autism Phenotype and Camouflaging: a Narrative Review. *Review Journal of Autism and Developmental Disorders, 8*, 306–317.

JASP Team. (2020). JASP (Version 0.14)[Computer software]. *University of Amsterdam*.

Johnson, S. A., Filliter, J. H., & Murphy, R. R. (2009). Discrepancies Between Self- and Parent-Perceptions of Autistic Traits and Empathy in High Functioning Children and Adolescents on the Autism Spectrum. Journal of Autism and Developmental Disorders,. *Journal of Autism and Developmental Disorders, 12*, 1706–1714. doi:doi.org/10.1007/s10803-009-0809-1

Karjalainen, L., Råstam, M., Paulson-Karlsson, G., & Wentz, E. (2019). Do autism spectrum disorder and anorexia nervosa have some eating disturbances in common? *European Child & Adolescent Psychiatry*, 69-78. doi:10.1007/s00787-018-1188-y

Kerr-Gaffney, J., Harrison, A., & Tchanturia, K. (2020). Autism spectrum disorder traits are associated with empathic abilities in adults with anorexia nervosa. *Journal of Affective Disorders, 226*, 273-281.

Kerr-Gaffney, J., Harrison, A., & Tchanturia, K. (2020). The social responsiveness scale is an efficient screening tool for autism spectrum disorder traits in adults with anorexia nervosa. *European Eating Disorders Review, 28*, 433–444. doi:10.1002/erv.2736

Kerr-Gaffney, J., Mason, L., Jones, E., Hayward, H., Ahmad, J., Harrison, A., . . . Tchanturia, K. (2020). Emotion Recognition Abilities in Adults with Anorexia Nervosa are Associated with Autistic Traits. *Journal of Clinical Medicine, 9*(1057).

Kinnaird, E., & Tchanturia, K. (2021). Looking beneath the surface: Distinguishing between common features in autism and anorexia nervosa. *Journal of Behavioral and Cognitive Therapy, 31*, 3-13.

Kloosterman, P. H., Keefer, K. V., Kelley, E. A., Summerfeldt, L. J., & Parker, J. D. (2011). Evaluation of the factor structure of the Autism-Spectrum Quotient. *Personality and Individual Differences, 50*(2), 310-314.

Lai, M.-C., Kassee, C., Besney, R., Bonato, S., Hull, L., Mandy, W., . . . Ameis, S. H. (2019). Prevalence of co-occurring mental health diagnoses in the autism population: a systematic review and meta-analysis. *The Lancet Psychiatry, 6*(10), 819-829.

Lai, M.-C., Lombardo, M. V., & Baron-Cohen, S. (2014). Autism. *The Lancet, 383*(9920), 896-910.

Lai, M.-C., Lombardo, M. V., Ruigrok, A. N., Chakrabarti, B., Auyeung, B., Szatmari, P., . . . Baron-Cohen, S. (2017). Quantifying and exploring camouflaging in men and women with autism. *Autism, 21*(6), 690-702. doi:10.1177/1362361316671012

Lang, K., Dapelo, M. M., Khondoker, M., Morris, R., Surguladze, S., Treasure, J., & Tchanturia, K. (2015). Exploring emotion recognition in adults and adolescents with anorexia nervosa using a body motion paradigm. *European Eating Disorders Review, 23*(4), 262-268.

Lang, K., Stahl, D., Espie, J., Treasure, J., & Tchanturia, K. (2014). Set shifting in children and adolescents with anorexia nervosa: An exploratory systematic review and meta-analysis. *International Journal of Eating Disorders, 47*(4), 394-399.

Leslie, M., Halls, D., Leppanen, J., Sedgewick, F., Smith, K., Hayward, H., . . . Tchanturia, K. (2020). Neural Correlates of Theory of Mind Are Preserved in Young Women With Anorexia Nervosa. *Frontiers in Psychology*(11). doi://doi.org/10.3389/fpsyg.2020.568073

Loomes, R., Hull, L., & Mandy, W. P. (2017). What Is the Male-to-Female Ratio in Autism Spectrum Disorder? A Systematic Review and Meta-Analysis. *Journal of the American Academy of Child & Adolescent Psychiatry, 56*(6), 466-474. doi:https://doi.org/10.1016/j.jaac.2017.03.013

Marı´-Bauset, S., Zazpe, I., Mari-Sanchis, A., Llopis-Gonza´lez, A., & Morales-Sua´rez-Varela, M. (2014). Food Selectivity in Autism Spectrum Disorders: A Systematic Review. *Journal of Child Neurology, 29*(11), 1554-1561.

Mason, T. B., Lesser, E. L., Dolgon-Krutolow, A. R., Wonderlich, S. A., & Smith, K. E. (2020). An updated transdiagnostic review of social cognition and eating disorder psychopathology. *Journal of Psychiatric Research, 20*(3). doi:10.1016/j.jpsychires.2020.11.019

Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & Prisma Group. (2009). The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *Journal of Clinical Epidemiology*. doi:10.1016/j.jclinepi.2009.06.005

NICE. (2017, December 20). *Autism spectrum disorder in under 19s: recognition, referral and diagnosis.* Retrieved January 15, 2021, from National Institute for Health and Care Excellence: https://www.nice.org.uk/guidance/cg128/chapter/Recommendations#autism-diagnostic-assessment-for-children-and-young-people

Nielsen, S., Anckarsäter, H., Gillberg, C., Gillberg, C., Råstam, M., & Wentz, E. (2015). Effects of autism spectrum disorders on outcome in teenage-onset anorexia nervosa evaluated by the Morgan-Russell outcome assessment schedule: a controlled community-based study. *Molecular Autism, 6*(14). doi:10.1186/s13229-015-0013-4

Piven, J., & Benjamin, J. (2002). The genetics of personality: the example of the broad autism phenotype. *Molecular Genetics and the Human Personality*, 43- 62.

Pooni, J., Ninteman, A., Bryant-Waugh, R., Nicholls, D., & Mandy, W. (2012). Investigating autism spectrum disorder and autistic traits in early onset eating disorder. *International Journal of Eating Disorders, 45*(4), 583-591.

Postorino, V., Scahill, L., Peppo, L. D., Fatta, L. M., Zanna, V., Castiglioni, M. C., . . . Mazzone, L. (2017). Investigation of Autism Spectrum Disorder and Autistic Traits in an Adolescent Sample with Anorexia Nervosa. *Journal of Autism and Developmental Disorders, 47*(4), 1051-1061. doi:10.1007/s10803-016-3023-y

(RevMan), R. M. (2020). [Computer program]. Version 5.4.1 . *The Cochrane Collaboration, Copenhagen: The Nordic Cochrane Centre*.

Rhind, C., Bonfioli, E., Hibbs, R., Goddard, E., Macdonald, P., Gowers, S., . . . Treasure, J. (2014). An examination of autism spectrum traits in adolescents with anorexia nervosa and their parents. *Molecular Autism, 5*(56).

Sampaio, F. T., Soneira, S., Aulicino, A., Martese, G., Iturry, M., & Allegri, R. F. (2013). Theory of mind and central coherence in eating disorders: Two sides of the same coin? *Psychiatry Research, 3,* 1116-1122.

Saure, E., Laasonen, M., Lepistö-Paisley, T., Mikkola, K., Ålgars, M., & Raevuo, A. (2020). Characteristics of autism spectrum disorders are associated with longer duration of anorexia nervosa: A systematic review and meta-analysis. *International Journal of Eating Disorders, 53*(7), 1015-1181.

Sedgewick, F., Kerr-Gaffney, J., Leppanen, J., & Tchanturia, K. (2019). Anorexia Nervosa, Autism, and the ADOS: How Appropriate Is the New Algorithm in Identifying Cases? *Frontiers in Psychiatry, 10*

Seitz, J., Konrad, K., & Herpertz-Dahlmann, B. (2018). Extend, Pathomechanism and Clinical Consequences of Brain Volume Changes in Anorexia Nervosa. *Current Neuropharmacology, 16*(8), 1164–1173. doi:10.2174/1570159X15666171109145651

Sfärlea, A., Greimel, E., Platt, B., Dieler, A. C., & Schulte-Körne, G. (2018). Recognition of emotional facial expressions in adolescents with anorexia nervosa and adolescents with major depression. *Psychiatry research, 262*, 586-594.

Spek, A. A., Rijnsoever, W. v., Laarhoven, L. v., & Kiep, M. (2020). Eating Problems in Men and Women with an Autism Spectrum Disorder. *Journal of Autism and Developmental Disorders, 50*(5), 1748-1755.

Stewart, M. E., & Austin, E. J. (2009). The structure of the Autism-Spectrum Quotient (AQ): Evidence from a student sample in Scotland. *Personality and Individual Differences, 47*(3), 224-228.

Tchanturia, K. (2021). *Supporting Autistic People with Eating Disorders: A Guide to Adapting Treatment and Supporting Recovery.* London: Jessica Kingsley Publishers .

Tchanturia, K., Adamson, J., Leppanen, J., & Westwood, H. (2019). Characteristics of autism spectrum disorder in anorexia nervosa: A naturalistic study in an inpatient treatment programme. *Autism, 21*(3), 123–130. doi:doi.org/10.1177/1362361317722431

Telléus, G. K., Jepsen, J. R., Bentz, M., Christiansen, E., Jensen, S. O., Fagerlund, B., & Thomsen, P. H. (2015). Cognitive Profile of Children and Adolescents with Anorexia Nervosa. *European Eating Disorders Review*, *23*(1), 34–42. doi:10.1002/erv.2337

Tomba, E., Tecuta, L., Crocetti, E., Squarcio, F., & Tomei, G. (2019). Residual eating disorder symptoms and clinical features in remitted and recovered eating disorder patients: A systematic review with meta-analysis. *The International Journal of Eating Disorders, 52*(7), 759-776.

Tonacci, A., Calderoni, S., Maestro, L. B., Fantozzi, P., FedericaCiuccoli, Morales, M. A., . . . Muratori, F. (2019). Autistic traits impact on olfactory processing in adolescent girls with Anorexia Nervosa restricting type. *Psychiatry Research, 274*, 20-26.

Treasure, J., & Schmidt, U. (2013). The cognitive-interpersonal maintenance model of anorexia nervosa revisited: a summary of the evidence for cognitive, socio-emotional and interpersonal predisposing and perpetuating factors. *Journal of Eating Disorders*, 1-13.

Volpe, U., Tortorella, A., Manchia, M., Monteleone, A. M., Albert, U., & Monteleone, P. (2016). Eating disorders: What age at onset? *Psychiatry Research, 238*, 225-227.

Wells, G., Shea, B., O'Connell, D., Peterson, J., Welch, V., Losos, M., & Tugwell, P. (2020). *The Newcastle-Ottawa Scale (NOS) for assessing the quality of nonrandomised studies in meta-analyses.* Retrieved 11 14, 2020, from The Ottawa Hospital Reseach Institute: http://www.ohri.ca/programs/clinical_epidemiology/oxford.asp

Westwood, H., & Tchanturia, K. (2017). Autism Spectrum Disorder in Anorexia Nervosa: An Updated Literature Review. *Current Psychiatry Reports*, *19*(7), 1535-1645. doi:10.1007/s11920-017-0791-9

Westwood, H., Eisler, I., Mandy, W., Leppanen, J., Treasure, J., & Tchanturia, K. (2016). Using the Autism-Spectrum Quotient to Measure Autistic Traits in Anorexia Nervosa: A Systematic Review and Meta-Analysis. *Journal of Autism and Developmental Disorder*, *46*(3), 964-77.

Westwood, H., Kerr-Gaffney, J., Stahl, D., & Tchanturia, K. (2017). Alexithymia in eating disorders: Systematic review and meta-analyses of studies using the Toronto Alexithymia Scale. *Journal of Psychosomatic Research, 99*, 66–81. doi:10.1016/j.jpsychores.2017.06.007

Westwood, H., Lawrence, V., Fleming, C., & Tchanturia, K. (2016). Exploration of Friendship Experiences, before and after Illness Onset in Females with Anorexia Nervosa: A Qualitative Study. *PLoS One, 11*(9). doi:10.1371/journal.pone.0163528.

Westwood, H., Mandy, W., & Tchanturia, K. (2017). Clinical evaluation of autistic symptoms in women with anorexia nervosa. *Molecular Autism, 8*(12). doi:10.1186/s13229-017-0128-x

Westwood, H., Mandy, W., Simic, M., & Tchanturia, K. (2018). Assessing ASD in Adolescent Females with Anorexia Nervosa using Clinical and Developmental

Measures: a Preliminary Investigation. *Journal of Abnormal Child Psychology, 46*(1), 183–192.

Westwood, H., Stahl, D., Mandy, W., & Tchanturia, K. (2016). The set-shifting profiles of anorexia nervosa and autism spectrum disorder using the Wisconsin Card Sorting Test: a systematic review and meta-analysis. *Psychological Medicine, 46*(9), 1809-1827.

Wouters, S., & Spekb, A. (2011). The use of the Autism-spectrum Quotient in differentiating high-functioning adults with autism, adults with schizophrenia and a neurotypical adult control group. *Research in Autism Spectrum Disorders, 5*(3), 1169-1175.

Section Three: Journal Article

An Evaluation of ASD Traits and the Social and Emotional Cognition of Adolescents with Anorexia Nervosa

Target journal: Eating Disorders: The Journal of Treatment & Prevention (Appendix 12: author guidelines)

Abstract

Research has indicated that individuals with Anorexia Nervosa (AN) commonly have traits consistent with Autism Spectrum Disorder (ASD). It has been hypothesised that these traits may result from nutritional deprivation. The present study examines ASD traits among adolescents with AN prior to prolonged periods of nutritional deprivation. Twenty-seven adolescents with AN were compared to 113 healthy control participants using the, the Reading of the Mind in the Eyes Test, Toronto Alexithymia Scale-20 and the Interpersonal Reactivity Index. Despite elevated Autism Quotient scores for the AN group, the only significant difference observed on this measure was the Attention Switching subscale. Contrary to expectation, the AN group scored more accurately on the Reading of the Mind in the Eyes Test. No difference was observed on the Toronto Alexithymia Scale. Comparisons on the Interpersonal Reactivity Index were non-significant with the exception of the Personal Distress scale. Group comparisons are caveated by an unusual pattern of responses in the control group potentially resulting from differences in admonition procedures. Examination of the AN group mean scores in the context of past literature indicate that ASD traits and levels of alexithymia are elevated prior to prolonged periods of nutritional deprivation.

Introduction

Anorexia Nervosa (AN) is a severe and potentially life-threatening eating disorder. It is characterised by a fear of weight gain and disturbed body image resulting in severe dietary restriction or other weight-loss behaviours (APA, 2013). AN is more common in females and where onset typically occurs during adolescence or young adulthood. Autism Spectrum Disorder (ASD) is a complex lifelong neurodevelopmental condition more common in males. ASD is commonly characterised by difficulties in social communication, atypical cognition, sensory sensitivities, restricted interests, and repetitive behaviour patterns (Lord et al., 2020). ASD is heterogeneous where the concept of a spectrum is used to explain variations in presentations. This ranges from more pronounced difficulties in the aforementioned areas and merit ASD diagnosis, to less pronounced ASD traits that do not result in functional impairment or meet the ASD diagnostic threshold. Where ASD traits are considerably apparent but do not meet the diagnostic threshold, they are generally considered to constitute the "Broader Autism Phenotype" (BAP), however this is not considered a specific diagnostic category (Gerdts & Bernier, 2011).

Empirical literature has indicated similarities among individuals with AN and ASD (Westwood & Tchanturia, 2017). Individuals with ASD commonly display cognitive and behavioural rigidity, a preference for sameness, intense and restricted interests (Lai et al., 2014). Within AN, this can present as perfectionism, preoccupation and rigidity around food, calories and weight (Kinnaird & Tchanturia, 2021). Similarities in cognitive functioning such as poorer performance in set-shifting and weak central coherence have been reported in both presentations (Sampaio et al., 2013; Westwood et al., 2016).

Increasingly research utilising ASD diagnostic tools among individuals with AN has indicated an overrepresentation of the condition among this group. In the largest diagnostic study

conducted to date, Westwood et al. (2018) reported that 10% of their sample of 40 adolescents with AN met the criteria for ASD. Further to this, research has also indicated that individuals with AN not meeting the criteria for ASD diagnosis commonly exhibit increased ASD traits relative to healthy control groups (Postorino et al., 2017; Westwood et al., 2017; Westwood et al., 2018). This indicates that individuals with AN have considerable ASD traits, however these may not be to the extent that they result in a functional impairment.

There is some debate surrounding explanations for ASD traits in AN. It has been proposed that traits mimicking ASD may occur due to the physiological sequelae or "neurological scarring" effect associated with the nutritional deprivation of the illness (Seitz et al., 2018). It has also been suggested that these traits represent an innate neurodevelopmental disposition that exists prior to the onset of the AN and acts as a risk factor for the disorder (Treasure & Schmidt, 2013). Baron-Cohen et al. (2013) propose that this pre-existing neurodevelopmental disposition is consistent with higher ASD traits. Westwood et al. (2018) combine the neurodevelopmental and starvation hypothesises and contend that these traits are likely pre-existing and become exacerbated during acute stages of the illness.

When considering these arguments in relation to the literature, research with acutely unwell adult AN cohorts has indicated a higher prevalence of ASD traits as examined through observational diagnostic assessments (Postorino et al., 2017; Westwood et al., 2017). However, research utilising these measures has indicated that ASD traits appear to be reduced within recovered cohorts (Kerr-Gaffney et al., 2020; Leslie et al., 2020; Sedgewick et al., 2019). Additionally, evidence regarding the prevalence of ASD and associated traits in groups in adolescents AN groups using these measures remains unclear, with traits either less pronounced or not apparent (Pooni et al., 2012; Postorino et al., 2017).

This variability in ASD traits between adults and adolescents with AN is also evident on self-report measures. Westwood et al. (2016) conducted a meta-analysis of seven studies comparing AN cohorts to healthy control groups on the Autism Quotient (AQ; Baron-Cohen et al., 2001). Findings indicated that the AN group had significantly more ASD traits with a large effect size. However, this effect size was reduced when the analysis was limited to participants under 18. An updated meta-analysis contrasting adolescents and young people with AN to healthy controls on the AQ (see Section Two) also indicated that adolescents and young people had significantly higher scores on the AQ than control groups. However, the effect size was lower than that reported by Westwood et al. (2016) for their adult analysis. Together these findings suggest that ASD traits are not as pronounced within younger cohorts.

Difficulties with social and emotional cognition are a principal diagnostic feature of ASD (APA, 2013) and are an area wherein people with AN have been reported to experience increased difficulties. Theory of Mind (ToM), empathy and alexithymia represent central and interrelated aspects of social and emotional functioning associated with ASD.

ToM refers to an individual's social imagination and their capacity to attribute mental states and intentions to others (Pedreño et al., 2017). There is substantive evidence indicating that people with ASD experience significant ToM difficulties (Baron-Cohen, 2000; Leppanen et al. 2018). Through the meta-analysis of 14 studies Bora and Köse (2016) reported increased ToM difficulties for AN group compared to control cohorts. Interestingly, meta-regression analysis indicated that longer duration of illness and lower body weight were associated with more severe deficits. Recent research has however, produced contrasting findings. Kerr-Gaffney et al. (2020) reported no significant differences in emotion recognition across an acute AN group, a weight restored AN group and a control group. Additionally, when assessing ToM Leslie et al. (2020) also found no differences between an AN group, a weight restored AN group, and a

control group. When considering the possible role of ASD traits in ToM and AN, Sedgewick et al. (2019) compared two AN groups, one with high ASD traits and the other low in ASD traits, to a control cohort. Contrary to expectation, no differences in ToM were observed across groups regardless of ASD traits.

Of note, in the aforementioned individual studies, participants were all under the age of 25. Given that participants were relatively young and that illness duration was likely limited, this may explain why ToM was not impacted. This suggests that impairments may be associated the duration of nutritional deprivation. This is also supported through adolescent AN research which has generally reported no differences in ToM functioning relative to comparison groups (Laghi et al., 2015; Nalbant et al., 2019; Sfärlea et al., 2018).

Alexithymia is a trait characterised by the inability to distinguish feelings and identifying emotions (Sifneos, 1973). Alexithymia often co-occurs with ASD (Haviland, 2016; Kinnaird et al., 2019) and has been reported among adult acute AN groups also. A meta-analysis of 22 studies reported that AN groups had significantly higher alexithymic traits than control groups (Westwood et al., 2017). Meta-regression analyses also indicated that older AN groups were higher in alexithymic traits. Alexithymia research conducted with recovered AN groups has reported mixed findings. Strigo et al. (2013) found that a recovered AN group did not differ significantly from healthy controls on reported levels of alexithymia. However, Kerr-Gaffney et al. (2020) did report a significant difference in levels of alexithymia between an acute AN group, a recovered AN group and a control group. Interestingly, the recovered group AN alexithymia score represented a mid-point between the acute AN and control groups.

Alexithymia research with adolescent AN groups is limited. Where it has been conducted, adolescents have been reported to experience similar levels of alexithymia as an adult AN

cohorts (Goozen et al., 2004). More recently, acutely ill adolescents were also seen to experience higher levels of alexithymia than healthy peers across two studies (Peres et al., 2020; Nalbant et al., 2019). This considered, adolescents with AN remain understudied with regard to alexithymia where its relationship to ASD traits has not been examined.

Empathy refers to the ability to understand and share the mental states of others (Greenberg et al., 2001). Sometimes divided into two categories; cognitive empathy denotes the ability to recognise and understand another's mental state. Affective empathy refers to the experience of emotional stimulation in response to the of emotion by others (Blair, 2005). Atypical empathic responses are common in ASD where they have been associated with difficulties with ToM (Baron-Cohen, 2010).

Research with regard to empathy in AN has produced mixed findings. A meta-analysis of 14 studies considering empathy in AN reported no difference in overall empathy between people with AN and healthy controls (Kerr-Gaffney et al., 2019). However, a specific analysis of eight studies evaluating cognitive empathy reported lower cognitive empathy scores in AN. Subsequently, Kerr-Gaffney et al. (2020) examined empathy and ASD traits in an acute AN group, a recovered AN group and a control group. Although a significant difference for ASD traits across groups, results were non-significant for empathy. Interestingly, both ASD traits and empathy in the recovered AN group reflected an intermediate profile between those acutely unwell and controls.

When considering adolescents, Calderoni et al. (2013) reported cognitive empathy deficits in adolescents with AN. Unlike the previous study, Peres et al. (2020) reported deficits in affective empathy in AN, but not cognitive empathy when compared to healthy controls. Nalbant et al. (2019) also reported significantly lower emotional and cognitive empathy levels in adolescent

AN. Baron-Cohen et al. (2013) however, found no significant difference in empathy in a sample of adolescents with AN when compared to peers.

In summary, research with acutely unwell adult and adolescent AN groups has indicated they exhibit a higher prevalence of ASD traits relative to control groups. However, these traits do not appear to be as pronounced within younger AN cohorts. There is also evidence to suggest that ASD and its associated traits and AN may share a common social and emotional phenotype. Findings concerning ToM, empathy and alexithymia among adolescents with AN have been mixed where there is evidence to suggest that aspects of functioning may be impacted by starvation or prolonged nutritional deprivation, however this remains understudied. Additionally, the mediating role of ASD traits on these social and emotional processes has not been adequately examined among adolescent AN groups.

Present Study

The present study seeks to investigate the presence of self-reported ASD traits and related aspects of social and emotional functioning in an adolescent AN group. This is to understand the extent to which ASD traits and difficulties in social and emotional functioning are present in AN in the early stages of the illness.

Hypothesises;

- Participants with AN will have significantly more self-reported ASD traits than the control group.
- Participants with AN will perform significantly worse than the control group on the RMET ToM task.
- Participants with AN will report significantly higher levels of alexithymia than the control group.

- Participants with AN will report significantly lower levels of empathy than the healthy control group.
- Exploratory analyses will also be conducted to assess if there is a statistically significant linear relationship between variables.

Methodology

Participants

The study assumed a cross-sectional design with two participant groups; (1) adolescents with AN attending a specialist eating disorder service and, (2) adolescents without an eating disorder. The AN group were required to have a DSM-5 diagnosis of AN, or Atypical AN (ATAN; Other Specified Feeding or Eating Disorder subcategory; APA, 2013) made by a consultant child and adolescent psychiatrist. Inclusion criteria required that participants were free of an intellectual disability and were between the ages of 12-19. Control group participants were required to be free of any parent or self-reported eating disorder and not currently attending mental health services.

Data Collection

Data for the AN group was collected at two separate clinics, one in the east and one in the south of Ireland. Clinicians in the service invited patients to participate as part of routine clinical evaluation. Here parents/guardians and patients were provided with information on the study (See appendix 3-10 for parent/guardian and participant AN information sheets and consent forms) and a hard copy questionnaire pack generally taken home to be completed. Individuals attending the service who had consented to be contacted for research purposes were invited to participate and were provided with the questionnaire pack via post.

Data collection for the control group was facilitated through a second level school in the south of Ireland. Participants were recruited through an information sheet and consent form distributed to parents/guardians. Students were then provided with information on the study and were required to indicate their assent before participating (See appendix 11-12 for parent/guardian and participant healthy control group information sheets and consent forms). Questionnaires were administered to this group through Qualtrics (2020) in school.

Data Collection Instruments

Demographic Information

All participants were asked to provide demographic information. Participants in the AN group consented to the service to providing their percentage weight for height (%WFH), date of admission and questionnaires administered by the service. Healthy control participants were requested to provide their weight and height but were informed that this was not mandatory.

Autism-Spectrum Quotient

The Autism-Spectrum Quotient (AQ) is a 50-item self-report screening measure of ASD traits commonly used in research assessing ASD traits in AN samples (Baron-Cohen et al., 2001; Baron-Cohen et al., 2013; Westwood et al., 2016). Questions require the individual to indicate their level of agreement with a statement. There is a maximum score of 50 for the Total scale, where a score over 32 is considered suggestive of ASD. Scores between 23-28 are considered reflective of the BAP (Wheelwright et al., 2010). The AQ also yields five subscales related to ASD; Social Skills, Attention Switching, Attention to Detail, Communication and Imagination. Within the present study, overall AQ reliability scores were acceptable, however, there was some variability between reliability scores for subscales (see Table 2).

The Reading of the Mind in the Eyes Test

The Reading of the Mind in the Eyes Test (RMET) assesses an individual's ability to identify a complex emotional and mental state in others and is used as a measure of ToM (Baron-Cohen et al., 2001). Examinees are presented with 36 images of the eye region of a person's face with four response choices of different emotions or mental states offered. The individual is required to identify the word best describing the emotion represented in the picture. The reliability alpha for the RMET in the present sample was .65 for the AN group and .73 for the healthy control group.

Toronto Alexithymia Scale

The 20-item Toronto Alexithymia Scale (TAS-20) is a self-report measure of alexithymia (Bagby et al., 1994). The TAS-20 provides a Total score and scores for three subscales; Difficulty Identifying Feelings, Difficulty Describing Feelings and Externally Orientated Thinking. The TAS-20 requires individuals to indicate their level of agreement with statements through a five-point Likert scale. Scores above 60 indicate alexithymia, with scores between 51 and 60 considered borderline (Lombardo et al., 2007). The reliability alphas for the TAS-20 Total were within acceptable levels. There was variability on subscales, but they were either acceptable or comparable to previously reported alpha levels (see Table 2).

The Interpersonal Reactivity Index

The Interpersonal Reactivity Index (IRI) is a 28-item self-report measure of empathy (Davis, 1980). It uses a five-point Likert scale that requires the individual to indicate the extent a statement describes them. The IRI has four subscales; The Perspective Taking scale denotes a person's ability to adopt another's viewpoint. The Fantasy scale assesses an individual's capacity to imagine themselves in fictional situations. Empathetic Concern examines the extent to which a person tends to sympathise with another. The Personal Distress subscale considers an individual's tendency to experience discomfort in response to stressful situations or in response to another's experience of distress. Prior research has combined these scale to yield cognitive and affective scales; however, factor analytic studies have recommended the use of individual subscales (Chrysikou & Thompson, 2016). The alpha levels for subscales on the IRI were considered acceptable (see Table 2).

AN Group Specific Measures

The following measures were not administered to the control group due to the risk of questions which could trigger distress and are reported through supplementary material.

Eating Disorder Examination Questionnaire- Adolescent

The Eating Disorder Examination Questionnaire - Adolescent (EDEQ-A) (Carter et al, 2001) is a 36-item self-report instrument that measures the severity of eating disorder symptoms. The EDEQ-A generates a Total score which gives an indication of overall severity. It also provides four subscales; Dietary Restraint relates to the extent to which one is limiting their intake; Weight Concern assess the level of preoccupation with weight; Shape Concern relates to the extent someone is focused on their shape; Eating Concern pertains to thinking about calories and fear of losing control eating. Higher scores indicate increased severity.

Eating Disorder Flexibility Index

The Eating Disorder Flexibility Index (EDFLIX) is a self-report measure of cognitive, behavioural and eating related rigidity (Dahlgren et al., 2019). The 36-item questionnaire requires individuals to indicate the extent a statement applies to them. It provides a Total Flexibility score, a General Flexibility score, and subscales relating to Food and Exercise Flexibility and Weight and Shape Flexibility. Higher scores indicate increased levels of flexibility.

Revised Children's Anxiety and Depression Scale

The Revised Children's Anxiety and Depression Scale (RCADS) is a 47-item self-report mental health screening questionnaire. The RCADS utilises a four-point Likert style response option that requires the individual to indicate the frequency to which a statement applies to them. The RCADS contains six subscales developed to correspond with DSM-IV diagnostic categories (see Table 5). It also provides a Total Anxiety and Depression score which was used for correlational analysis. The RCADS provides t-scores which when above 65 are considered within the borderline range with scores over 70 deemed in the clinical range (Chorpita et al., 2000).

Data Analysis

Analyses were conducted using SPSS (IBM Corp, 2020). The AN and healthy control group were compared across dependent variables using independent samples t-tests for normally distributed data. Bonferroni corrections were applied by multiplying the observed *p*-value by the number of tests conducted for each measure (Bland & Altman, 1995). For variables not normally distributed, the Mann-Whitney U Test was utilised. For group comparisons statistical significance was assumed at the $p<.05$ and $p<.01$ levels. Within the AN group, correlation analyses were performed using a two-tailed Pearson's correlation coefficient to explore the relationships between variables of specific interest to the research study where statistical was assumed at $p<.05$ and $p<.01$ levels.

Ethical Approval

Ethical approval for the project was granted by the University College Cork Clinical Psychology Research Ethics Committee (See appendix 23). All participant parents/guardians provided informed consent and adolescents provided informed assent.

Results

Demographic Information

One hundred forty individuals participated in the study. This was made up of 27 individuals with AN, 6 male and 21 female (see Table 1). There were 113 participants in the healthy control group, of which 56 were male and 57 female. Within the AN group, 24 participants had AN Restrictive Type (AN-R), and three had a diagnosis of ATAN. A Mann-Whitney U test indicated no significant difference in age between groups. The overall sample was predominantly white (96%). One person within the control sample reported a diagnosis of ASD. To avoid confounding within the healthy control group, this participant was removed. One person in the AN group had a diagnosis of ASD; as this is common in AN, this participant was included.

There was height and weight data for 26 participants in the AN group. In the control sample, 72 participants provided height and weight data. Both the overall AN (t=4.28; df=96; p<.01), and AN-R group (t=7.5; df=83.83; p<.01) had a significantly lower %W4H than the control group. There was no significant difference in weight between the ATAN and control group.

AQ

For the AN group, the AQ Total mean score was higher than the control group (see Table 2). Independent samples t-tests indicated no difference between groups on the AQ Total scale or subscales with the exception of the Attention Switching subscale, where a significant difference was observed (t=-2.25; df=138; p<.05; see Table 3). The mean scores for both groups were below the threshold of the BAP (23≤; Wheelwright et al., 2010). However, frequency analysis indicated that 33.3% (n=11) of the AN group had AQ scores above the BAP threshold of 23. Three of these participants (11.11%) scored above the threshold suggestive of ASD (32≤;

Baron-Cohen et al. 2001). Within the healthy control group, 22.1% (n=30) of the sample scored above the BAP threshold and one person scored above the threshold indicative of ASD (.88%).

Correlational analysis indicated a positive relationship between the AQ and the Perspective Taking subscale of the IRI (r=.622; n=26; p<.01; see Table 5) and the RCADS Total Anxiety scale (r=.466; n=22; p<.05). A significant negative correlation between the AQ and the EDFLIX Total (r=-.450; n=24; p<.05) was also observed with higher AQ scores associated with reduced flexibility.

RMET

The mean score for the AN group on the RMET was considerably higher than the healthy control group. Results of a two-tailed independent samples t-test indicated a significant difference between groups (t=-2.67; df=126; p<.01; see Table 3). There was a significant negative correlation between the RMET and TAS-20 Total score (r=-.423; n=26; p<.05; see Table 5).

TAS-20

The TAS-20 Total mean score for the AN group was 61.69 (SD=9.12) and within the alexithymic range (60<; Craparo et al., 2015). The mean score for the healthy control group was lower 58.66 (SD=10.09), and in the borderline alexithymic range (51-60; see Table 2). One-tailed independent samples t-tests indicated no significant difference between the AN and healthy control group on TAS-20 Total or subscales (see Table 3). There was a significant positive correlation between the TAS-20 Total and the EDEQ-A Total scale (r=.424; n= 24; p<.05; see Table 5).

IRI

One-tailed independent samples t-tests indicated no significant difference on the IRI on the Perspective Taking and Fantasy subscales (see Table 3). A group difference was observed on the Personal Distress subscale (t=-1.91; df=129; p<.05), mean scores indicated that the AN group reported significantly higher scores on the Personal Distress scale. A one-tailed Mann-Whitney U test indicated no significant difference on the Empathetic Concern subscale. The Perspective Taking subscale was significantly correlated with the Total Anxiety and Depression scale (r=.434; n=21; p<.05). There was a significant negative correlation between the Personal Distress subscale and the EDFLIX Total (r=-.434; n=23; p<.05). It was also significantly correlated with the Total Anxiety and Depression scale on the RCADS (r=.498; n=21; p<.05).

Table 1. *Demographic Information*

Group	**AN (*N*=27)**			**HC (*N*=113)**			**Group comparison**			
	n	***M***	***SD***	***n***	***M***	***SD***	***t***	***df***	**MWU**	***p*-value**
Age	27	15.52	1.6	112	15.77	0.42			1455	.711
%Female	77.8%			50.4%						
%W4H	26	92.59%	10.16	72	105.39	13.93	4.28	96		.001**
AN-R	23	89.72%	1.5		105.39	13.93	7.5	83.83		.001**
ATAN	3	114.51%	7.9		105.39	13.93	-1.12	73		.266
Weeks since admission	26	24	32	-	-	-	-	-		-

AN = Anorexia Nervosa, HC = Healthy Controls, %W4H = Percentage Weight for Height, AN-R= AN-Restrictive Type, ATAN= Atypical-AN, MWU= Mann-Whitney U
**Denotes significance at .05 level, ** denotes significance at .001 level*

Table 2. *Participant Mean Scores*

	AN				HC			
	α	***n***	***M***	***SD***	***α***	***n***	***M***	***SD***
AQ Total	.79	27	21.11	6.89	.66	113	19.12	5.4
Social skills	.75		3.56	2.67	.61		2.53	2
Attention switching	.66		5.89	2.29	.46		4.81	1.93
Attention to detail	.69		5.59	2.46	.49		5.50	2.01
Communication	.35		3.67	1.79	.49		3.42	1.94
Imagination	.32		2.41	1.60	.42		2.85	1.79
RMET	.65	27	24.59	4.49	.73	101	21.60	5.30
TAS-20 Total	.71	26	61.69	9.12	.74	111	58.66	10.09
Difficulty identifying feelings	.81		22.31	5.78	.81		20.54	6.01
Difficulty describing feelings	.67		17.35	3.73	.67		16.03	4.12
Externally orientated thinking	.31		22.04	3.71	.54		22.09	4.66
IRI		26				105		
Perspective taking	.69		18.12	4.87	.72		15.99	5.12
Fantasy	.68		16.77	5.07	.74		17.72	5.69
Empathic concern	.52		18.65	3.58	.69		18.01	5.06
Personal distress	.75		15.81	4.86	.68		12.83	4.94

AN = Anorexia Nervosa, HC = Healthy Controls, AQ =Autism Quotient, RMET = Reading the Mind in The Eyes Task, TAS-20= Toronto Alexithymia Scale, IRI= Interpersonal Reactivity Index

Table 3. *Group Comparisons*

	AN - HC			
	t	***df***	***MWU***	***p***
AQ Total	-1.61	138		.32
Social skills	-2.22	138		.48
Attention switching	-2.50	138		.03*
Attention to detail	-.19	138		.99
Communication	-.59	138		.99
Imagination	1.17	138		.99
RMET	-2.67	126		.004**
TAS Total	-1.40	135		.32
Difficulty identifying feelings	-1.35	135		.32
Difficulty describing feelings	-1.49	135		.24
Externally orientated thinking	.053	135		.99
IRI				
Perspective taking	-1.91	129		.087
Fantasy	.78	129		.63
Empathic concern			1232.5	.22
Personal distress	-2.76	129		.0105*

AN = Anorexia Nervosa, HC = Healthy Controls, AQ =Autism Quotient, RMET = Reading the Mind in The Eyes Task, TAS-20= Toronto Alexithymia Scale, IRI= Interpersonal Reactivity Index MWU= Mann-Whitney U
**denotes significance at .05 level, ** denotes significance at .01 level*
Note: p-values corrected for multiple comparisons

AN Group Specific Measures

Mean scores and standard deviations were calculated for AN specific measures to provide information on the levels of eating disorder severity and mental health pathology (see Table 4). There were considerable levels of eating and mental health pathology; further analysis and commentary are available in the supplementary material. When considering correlations between eating disorder specific measures there was a significant negative correlation between the EDEQ-A Total and the EDFLIX Total scores ($r=-.742$; $n=23$; $p<.01$). The was also a significant negative correlation between the EDFLIX Total and Total Anxiety and Depression scale on the RCADS. ($r=-.713$; $n= 22$; $p<.01$).

Table 4. *AN Group Specific Measures*

	AN		
	n	***M***	***SD***
EDEQ-A Total	25	2.57	1.9
Dietary Restraint		2.3	2.08
Eating Concern		2.11	1.7
Shape Concern		3.12	2.21
Weight Concern		2.74	2.09
EDFLIX Total	24	123.58	25.83
General Flexibility		56.88	11.03
Food and Exercise Flexibility		45.63	20.67
Weight and shape Flexibility		20.67	9.03
RCADS	22		
Total Anxiety and Depression		57.73	12.21
Total Anxiety		56.82	12.21
Separation Anxiety		57.95	14.29
Social Phobia		57.95	9.4
General Anxiety		50.64	10.42
Panic		55.82	13.29
OCD		51.73	11.76
Depression		58.41	12.21

EDEQ-A = Eating Disorder Examination Questionnaire – Adolescent, EDFLIX = Eating Disorder Flexibility Index, RCADS = Revised Children's Anxiety and Depression Scale

Table 5. *Correlations Table*

	1	2	3	4	5	6	7	8	9	10
1. %WFH										
2. AQ	-.036									
3. RMET	-.181	-.15								
4. TAS	.34	.198	-.423*							
IRI										
5. Fantasy	.103	.2	.049	-.268						
6. Perspective taking	.188	.622**	-.227	.146	.325					
7. Empathic concern	-.095	.268	.137	-.146	.455*	.446*				
8. Personal distress	.059	.101	.095	.043	.243	.116	.241			
9. EDEQ-A-Total	.4	.194	-.234	.424*	-.214	.232	.02	.378		
10. EDFLIX-Total	.017	-.450*	-.17	-.1	-.047	-.214	-.023	-.434*	-.742**	
11. RCADS - Total Anxiety and Depression	-.212	.412	-.039	.219	.372	.434*	.354	.498*	.384	-.713**

%W4H = Percentage Weight for Height, AQ =Autism Quotient, RMET = Reading the Mind in The Eyes Task, TAS-20= Toronto Alexithymia Scale, IRI= Interpersonal Reactivity Index

** Correlation is significant at the .01 level (2-tailed) * Correlation is significant at the .05 level (2-tailed).

Discussion

The present study sought to investigate ASD traits and the social and emotional cognitive profiles of young people with AN. The present analyses indicated that the adolescent AN group did not have significantly more ASD traits as measured by the AQ than the control sample. The exception to this was the Attention Switching subscale, where the AN cohort reported significantly higher scores. This result suggests that the AN group experience increased difficulty with repetitive behaviour and shifting their attention between tasks or patterns of thinking. In the context of AN this may contribute to the ongoing preoccupation with food and weight that perpetuates the disorder.

The lack of a significant group difference on the AQ Total and most subscales was contrary to expectation. This should be considered in the context of both groups having considerably higher AQ mean scores when compared to the large previously published control group mean scores (Baron-Cohen et al., 2001; Baron-Cohen et al., 2013). Although high mean scores were hypothesised in the AN group, it was unforeseen in the healthy control group. This may indicate that on average adolescents with AN do not have more ASD traits than healthy adolescents.

Interestingly, the frequency analysis signified a higher percentage of the AN group reporting scores within the BAP range and above the cut off indicative of ASD than in the control group. This is suggestive of a considerable proportion of adolescents with AN, but not all reporting higher ASD traits as measured by the AQ. However, it should be considered that these cut off thresholds are based on a relatively short self-report measure where it cannot be assumed that these higher scoring individuals present with sub-clinical ASD.

When considering the present AQ scores in the context of prior adolescent AN research, the present AN AQ Total mean score was higher than any previously reported (Baron-Cohen et al., 2013; Björnsdotter et al., 2019; Calderoni et al., 2015; Karjalainen et al., 2019; Tonaccai et

al., 2019). The presently observed absence of a group difference on AQ is also inconsistent with the aforementioned studies, with the exception of Tonaccai et al. (2019). The only study to publish results for subscale comparisons was Calderoni et al. (2015), where they also reported a significant group difference on the Attention Switching subscale.

Correlational analysis indicated that higher AQ scores were associated with the increased Perspective Taking on the IRI. This was counter to expectation due to ASD traits generally being associated with ToM difficulties. This relationship may demonstrate an adaptive socio-cognitive strategy to help camouflage ASD traits (Hull et al., 2020), however, given the small number of items on the Perspective Taking subscale, this should be interpreted with caution. Higher AQ scores were also associated with an increased eating disorder related rigidity measured by the EDFLIX Total. This also reflects the main finding on the Attention Switching subscale and provides evidence that the AN group experience challenges in cognitive and behavioural flexibility that may contribute AN severity.

There was a significant group difference for the RMET; however, this was not in the direction originally hypothesised. Caution is required in the interpretation of this finding due to an unusually low mean score for the control group. For reference, this was lower than the mean score previously reported for an ASD group (Baron-Cohen et al., 2001). This limits the inferences that can be drawn from the between-group comparison. This may be accounted for through differences in administration procedures between groups. The RMET requires a considerable degree of concentration in order to accurately respond to the stimuli. As a result of the healthy control group being administered this measure in an uncontrolled environment, this may have led to less accurate responding and resulting a considerably lower mean score.

The AN group mean score was however similar to those previously reported for some non-clinical samples (Laghi et al. 2020; Tella et al. 2020; Vellante et al. 2013). Although not a

direct comparison, this may suggest that the present AN sample do not experience impairments in ToM. The present group difference, albeit caveated by concerns around the healthy control groups response style contrasts prior research using the RMET with adult AN samples where significant differences have been observed (Harrison et al., 2009; Redondoa & Herrero-Fernández, 2018). However, it is in line with previous studies indicating that ToM is not impaired in AN (Kerr-Gaffney et al., 2020; Laghi et al., 2015; Nalbant et al., 2019) irrespective of increased ASD traits (Sedgewick et al., 2019).

Despite higher ASD traits in the present AN group, this does not appear to have impacted ToM performance. It has been proposed that people with ASD, may "compensate for ToM difficulties by using executive functioning strategies to learn to recognise different facial expressions" (Hull et al., 2020 p.309). This use of socio-cognitive strategies to mask ASD traits is one possible explanation for the AN groups performance on the RMET. The RMET was negatively correlated with TAS-20 Total. This is logical as if one has difficulty identifying their own emotions, they will likely have difficulty doing this for another.

For the TAS-20, there were no statistically significant differences on the Total and subscales were observed between groups. However, the Total mean score for the AN group was above the threshold considered alexithymic and is indicative of considerable difficulties in identifying and describing emotions. The control group score was also considerably high and at the upper threshold of the borderline alexithymic range. Although higher alexithymic traits were expected in the AN group, the control group scores were unexpectedly high. This may indicate that adolescents with AN do not have significantly more alexithymic type difficulties than their healthy counterparts. Alternately, this may reflect a pattern of difficulties consistent with the healthy control group AQ scores or differences resulting from differing data collection procedures. This limits the inferences that can be drawn from between-group comparisons.

As observed in the present study, higher mean scores on the Difficulty Identifying Feelings and Difficulty Describing Feelings subscales relative to controls were consistent with the pattern reported through a meta-analysis examining alexithymia in AN (Westwood et al., 2017). Compared to previous adolescent AN research, the present AN group mean total and subscales were considerably higher than those reported by Nalbant et al. (2019) and Peres et al. (2020). Contrary to the present result, these studies reported that the AN group reported significantly more difficulties than the control group for the TAS Total and on the Difficulty Identifying Feelings and Difficulty Describing Feelings subscales.

Although the present findings were non-significant, reference to interpretive categories and prior research indicates that adolescents with AN experience higher levels of alexithymia than controls. Specific difficulties appear to relate to identifying and describing feelings with limited differences reported for externally orientated thinking. The TAS-20 was positively correlated with the EDEQ-A Total, where alexithymia was associated with increased eating disorder severity. This may suggest that alexithymia may result in increased eating disorder symptomatology, potentially as a maladaptive coping mechanism in response to poor emotional awareness and limited opportunity to articulate distress.

On the IRI, although between group analyses were non-significant, consideration of the mean scores indicated the AN group reported more Perspective Taking behaviours. Peres et al. (2020) also reported a non-significant difference between their AN and healthy control groups. In contrast, Calderoni et al. (2013) reported that their AN group had significantly lower Perspective Taking scores. Perspective Taking was positively correlated with the RCADS Total Anxiety and Depression scale which may indicate that increased perspective taking behaviour may be associated with increased internalising difficulties in AN.

The AN and healthy control group mean scores on the Fantasy subscale were approximate to each other and similarly to Peres et al. (2020), there was no significant difference on this scale. Calderoni et al. (2013) however, did report that their AN sample had significantly lower fantasy scores. Mean scores on the Empathetic Concern scale were similar in both groups with no significant difference observed. This is in line with that reported by both Peres et al. (2020) and Calderoni et al. (2013) where no significant differences on the Empathetic Concern scale were reported also.

The AN group reported significantly higher scores on the Personal Distress scale. This indicates that the AN group experience more distress in response to others discomfort or stressful situations. This finding matched that of Peres et al. (2020), where their AN group reported significantly higher scores on the Personal Distress scale. Calderoni et al. (2013) however, did not report a significant difference on this scale. Increased Personal Distress was associated with reduced flexibility as measured by the EDFLIX Total. Higher Personal Distress was also positively associated with the RCADS Total Anxiety and Depression scale. Through being correlated with a measures of reduced flexibility and internalising difficulties, this may suggest that the rigidity associated with AN and comfort derived from this may be a maladaptive strategy to help manage anxiety or distress.

The comparison of results with prior adolescent AN research using the IRI subscales was generally mixed. This is excluding the Empathy scale, where in addition to the present study, both Calderoni et al. (2013) and Peres et al. (2020) reported no significant differences between groups. This suggests that empathy, as measured by the IRI, is not impaired in AN. However, there is a disparity in results across studies on other IRI subscales. An absence of significant difference between adolescent AN groups and healthy controls has also been reported on other measures of empathy (Baron-Cohen et al., 2013; Nalbant et al., 2019). The present results are also consistent with a meta-analysis of 14 studies assessing empathy in AN which reported no

difference in overall empathy scores (Kerr-Gaffney et al., 2019). These results taken in conjunction with prior research suggest that empathy in AN is generally not impaired.

Theoretical Implications of Findings

Considering these findings in the context of theoretical explanations for ASD traits in AN, it has been proposed that these traits result from the physiological consequences of starvation or "neurological scar effect" (Seitz et al., 2018). Although the present AN group %WFH was considered low, it was not severely low (APA, 2013). It was also relatively higher than those reported by other adolescent AN studies assessing ASD traits (Calderoni et al., 2015; Karjalainen et al., 2019; Lang et al., 2015; Leslie et al., 2020; Tonaccai et al., 2019). With respect to the neurological scar effect hypothesis, the participants in the present study were closer to a healthy weight than those in previous research. Despite this, the present sample still had higher ASD traits. This suggests that the observation of ASD traits in AN is not entirely due to acute nutritional deprivation. Additionally, as the mean time since admission was six months for the present sample, the period of nutritional deprivation in the AN group was relatively limited. This provides evidence that ASD traits are present during the early stages of the illness. The reduced contribution of starvation to ASD traits suggests that these traits may represent an innate neurodevelopmental disposition potentially associated with an increased risk of developing AN.

Practical Implications

Increasingly research has indicated that individuals with AN commonly have ASD and associated traits. This requires services to be suitably skilled at recognising this presentation and adapting treatment approaches where necessary. This may highlight a need for further training surrounding ASD in eating disorder services. When providing interventions to individuals with increased ASD traits, services may benefit from incorporating practices utilised working therapeutically with ASD groups such as visual aids, written worksheets, the

skills practice, and opportunities for generalising learning (Reaven & Hepburn, 2003; Rotheram-Fuller & MacMullen, 2011; Moree & Davis, 2010). Additionally, patients with increased levels ASD traits may also struggle with specific types of intervention such as group therapy. Services should also be cognisant of increased levels of alexithymia in AN cohorts. This may also involve assessing for this and where appropriate, incorporating psychoeducation and emotional literacy supports into interventions.

Limitations

There are a number of limitations in the present study. Considered initially is the differing data collection procedures applied to both groups where responses for the AN group were collected through hard copy measures generally completed at home. Due to COVID-19, the researcher was unable to administer questionnaires to the control group in person. Instead, they were administered online through data collection software. These differing administration procedures may have influenced responding particularly in the healthy control group as it is unclear as to what the response conditions were like. It is possible there may have been distractions that may have resulted in careless or rushed responding. This may account for unusual scores across a number of measures and limits the inferences that can be drawn from between-group comparisons in the study.

Other limitations to consider are the small self-selecting AN sample where heterogeneity concerning age, gender, weight, AN subtype and stage of treatment may have influenced responses. The present sample were generally not as underweight and had a shorter illness duration than adolescent AN groups reported within prior literature. This may have implications on the generalisability some of findings. Caution is also advised when considering correlations between scales and subscales within the analysis given that subscales are based on a small number of items

Strengths

The present study is one of the more comprehensive examinations of ASD traits in conjunction with social and emotional cognition in adolescent AN. It was also the first study to examine the EDFLIX in an adolescent AN sample which is helpful in elucidating the relationship between eating disorder rigidity and ASD traits. Although not investigated statistically, the inclusion of males in the AN sample is an important contribution as this group are underrepresented in the literature. Another strength of the present study is that AN participants had a generally short duration of illness. Additionally, the present study employed a more conservative approach than previous research where statistical corrections were applied when multiple tests were performed to improve the reliability of findings.

Future Research

There remains an absence of longitudinal research relating to ASD traits, or aspects of social and emotional cognition predating AN that may act as risk factors in the disorder's pathogenesis. Further research with adolescents is also required to examine if areas identified as elevated within the present research remain so following recovery. To date, AN research has predominantly utilised the AQ. Future research is directed toward incorporating different instruments measuring different or more subtle aspects of ASD traits in AN. Despite the present contribution, there remains a dearth of research considering ASD traits in males with AN. Additional research efforts with males is required to examine if they share a similar presentation with respect to ASD traits and social and emotional cognition as females.

Conclusion

The present results indicated that adolescents with AN do not have significantly more ASD traits than the present healthy control group as measured by the AQ. This considered, a considerably percentage of the AN sample had scores consistent with the BAP and above the self-report threshold considered indicative of ASD relative to the control group. Findings

suggests that these traits represent a neurodevelopmental disposition consistent with ASD, as opposed to these traits resulting from either acute or prolonged periods of nutritional deprivation. Increased ASD related traits in the AN sample do not appear to be accompanied by ToM difficulties or deficits in empathy when compared to the healthy control group and viewed in the context of previous research. Although findings relating to alexithymia were also non-significant, AN participants reported high levels of alexithymia. It is unclear if the profile of difficulties observed in the AN group corresponds to a specific ASD phenotype where ToM deficits and empathy may be less impacted. Alternately, this type of profile may represent a constellation of specific ASD traits, in combination with poor introspective ability and which may act as risk factor for AN.

Journal Article Supplementary Material

EDEQ-A

In the present sample, the Total mean was lower than the mean score reported in a large clinical sample of female adolescents (*N*=570; *M*=3.03; *SD*=1.71), but higher than the mean reported for a non-clinical sample in the same study (*N*=487; *M*=1.0; *SD*=2.18; Forsen Mantilla et al., 2017). It should be noted that the clinical sample of this group was made up of adolescents with various eating disorders, 44.7% of which had AN. Comparisons with this study are made throughout the EDEA-Q subscales to aid interpretation.

For subscales, the mean score for the Dietary Restraint scale was lower than the mean reported in the sample involved in the development of the measure (*M*=2.*92*; *SD*=2.00) but higher than the non-clinical sample (*M*=.78; *SD*=2.3). The mean score for the Eating Concern subscale was slightly lower than the clinical sample mean 2.33 (*SD*=1.56) and higher than the non-clinical sample mean of .61 (*SD*=.90). The Shape Concern subscale was the highest for the present AN sample on the EDEQ-A. This was also lower than the mean reported in the standardisation sample (*M=3.77*; *SD*=1.92) and higher than the non-clinical sample of adolescents used as reference (*M*=1.41; *SD*=1.42). The Weight Concern subscale was lower within the present sample than clinical mean samples (*M*=3.12; *SD*=1.88) and higher than non-clinical adolescents (*M*=1.34; *SD*=1.3).

Overall the AN group mean scores on the EDEQ-A were similar to the mean scores of the clinical sample used as a reference group. Mean scores were also considerably higher than the means of a non-clinical sample. These comparisons collectively indicate the present sample experiencing eating disorder severity consistent with a clinical eating disorder sample.

EDFLIX

Higher scores on this measure are associated with increased flexibility, and lower scores indicate increased rigidity. The EDFLIX Total mean score for the present sample was higher than norms for an adult AN group (*N*=114; *M*=95.4; *SD*=23.4) published as part of the development of the measure (Dahlgren et al., 2019). The present mean was lower than the Total score for the non-clinical sample published within the same study (*N*=288; *M*=176.5; *SD*=19.9), indicating increased rigidity relative to a control sample. See Table 4. for mean scores.

The mean score for the General Flexibility scale was marginally higher than the clinical standardisation sample mean of 50.0 (*SD*=13.8) but considerably lower than the standardisation non-clinical sample of 81.1 (*SD*=11.1.8). The present mean for the Food and Exercise Flexibility subscale was higher than the AN sample mean 33.8 (*SD*=10.5) and lower than the non-clinical sample (*M*=64.7; *SD*=8.7). The mean for the Weight and Shape Flexibility subscale was also higher than the AN group in the measure development sample (*M*=11.8; *SD*=2.6) but lower than the non-clinical sample (*M*=30.4; *SD*=4.8).

Although the mean scores in the present sample are not at the same level of eating related rigidity reported in the AN group within the normative sample, it is clear that the present sample experience considerably more eating related rigidity than a non-clinical sample.

RCADS

For the Total Anxiety and Depression scale, approximately 20% of the sample scored within the borderline or clinical range. For the Total Anxiety scale, this figure was 13.6%. On the Separation Anxiety subscale, 22.7% of the sample scores were within the borderline or clinical range. For the Social Phobia scale, 18.2% of the sample were in the borderline or clinical range. On the General Anxiety subscale, 13.6% of the sample were with the borderline or clinical

range. This figure was 13.6% for the Panic subscale and 9.1% for the OCD subscale. For the Major Depressive Disorder subscale, 22.7% of the sample scored within the borderline or clinical range.

Examination of the RCADS scale scores indicates that a considerable percentage of the AN group may experience a variety of mental health difficulties, as indicated through the screening questionnaire. The foremost of these difficulties within the sample are Anxiety and Depression, Separation Anxiety and Social Phobia.

References

APA. (2013). *Diagnostic and statistical manual of mental disorders*. Washington DC: American Psychiatric Publishing.

Bagby, R. M., Parker, J. D., & Taylor, G. J. (1994). The twenty-item Toronto Alexithymia Scale--I. Item selection and cross-validation of the factor structure. *Journal of Psychosomatic Research, 38*(1), 23-32.

Baron-Cohen, S. (2010). Empathising, systemising, and the extreme male brain theory of autism. *Progress in Brain Research, 186*, 167-175.

Baron-Cohen, S., Jaffa, T., Davies, S., Auyeung, B., Allison, C., & Wheelwright, S. (2013). Do girls with anorexia nervosa have elevated autistic traits? *Molecular Autism, 4*(24). doi:https://doi.org/10.1186/2040-2392-4-24

Baron-Cohen, S., Wheelwright, S., Hill, J., Raste, Y., & Plumb, I. (2001). The "Reading the mind in the eyes" Test revised version: A study with normal adults, and adults with Asperger syndrome or high-functioning autism. *Journal of Child Psychology and Psychiatry, 42*(2), 241-251.

Baron-Cohen, S., Wheelwright, S., Skinner, R., Martin, J., & Clubley, E. (2001). The Autism-Spectrum Quotient (AQ): Evidence from Asperger Syndrome/High-Functioning Autism, Malesand Females, Scientists and Mathematicians. *Journal of Autism and Developmental Disorders, 31*, 5-17.

Blair, R. (2005). Responding to the emotions of others: Dissociating forms of empathy through the study of typical and psychiatric populations. Consciousness and Cognition, 14(4), 698-718.

Bland, J. M., & Altman, D. G. (1995). Multiple significance tests: the Bonferroni method. BMJ, 310(6973), 170.

Björnsdotter, M., Davidovic, M., Karjalainen, L., Starck, G., Olausson, H., & Wentz, E. (2018). Grey matter correlates of autistic traits in women with anorexia nervosa. *Journal of Psychiatry and Neuroscience, 43*(2), 79–86.

Bora, E., & Köse, S. (2016). Meta-analysis of theory of mind in anorexia nervosa and bulimia nervosa: A specific İmpairment of cognitive perspective taking in anorexia nervosa? *International Journal of Eating Disorders, 49*(8), 739-740.

Calderoni, S., Fantozzi, P., Maestro, S., Brunori, E., Narzisi, A., Balboni, G., & Muratori, F. (2013). Selective cognitive empathy deficit in adolescents with restrictive anorexia nervosa. *Neuropsychiatric Disease and Treatment, 9*, 1583-1589.

Carter, J. C., Stewart, D. A., & Fairburn, C. G. (2001). Eating disorder examination questionnaire: norms for young Eating disorder examination questionnaire: norms for young. *Behaviour Research and Therapy, 39*, 625–632.

Chorpita, B. F., Yim, L., Moffitt, C., Umemoto, L. A., & Francis, S. E. (2000). Assessment of symptoms of DSM-IV anxiety and depression in children: A Revised Child Anxiety and Depression Scale. *Behaviour Research and Therapy, 38,, 38*(8), 835-855.

Chrysikou, E. G., & Thompson, W. J. (2016). Assessing cognitive and affective empathy through the interpersonal reactivity index: an argument against a two-factor model. *Assessment*, *23*(6), 769-777.

Craparo, G., Faraci, P., & Gori, A. (2015). Psychometric properties of the 20-item Toronto Alexithymia Scale in a group of Italian younger adolescents. *Psychiatry investigation*, *12*(4), 500.

Dahlgren, C. L., Hage, T. W., Wonderlich, J. A., & Stedal, K. (2019). General and Eating Disorder Specific Flexibility: Development and Validation of the Eating Disorder Flexibility Index (EDFLIX) Questionnaire. *Frontiers Psychology, 10*(663).

Davis, M. (1980). A multidimensional approach to individual differences in differences in empathy. *JSAS Catalog of Selected Documents in Psychology, 10*.

Dalle-Grave, R., & Calugi, S. (2020). *Cognitive Behavior Therapy for Adolescents with Eating Disorders.* New York: Guilford Press.

Forsen Mantilla, E., Birgegård, A., & Clinton, D. (2017). Factor analysis of the adolescent version of the Eating Disorders Examination Questionnaire (EDE-Q): results from Swedish general population and clinical samples. *Journal of Eating Disorders*, *5*(1), 1-8.

Gerdts, J., & Bernier, R. (2011). The Broader Autism Phenotype and Its Implications on the Etiology and Treatment of Autism Spectrum Disorders. *Autism Research and Treatment, 2011*.

Goozen, E. F.-B., Cohen-Kettenis, P. T., Elburg, A. v., Wildt, M. d., Stevelmans, E., & Engeland, H. v. (2004). Emotional functioning in anorexia nervosa patients: adolescents compared to adults. *Depression and Anxiety, 19*(1), 35-42.

Greenberg, L. S., Elliott, R., Watson, J. C., & Bohart, A. C. (2001). Empathy. *Psychotherapy: Theory, research, practice, training*, *38*(4), 380.

Harrison, A., Sullivan, S., Tchanturia, K., & Treasure, J. (2009). Emotion recognition and regulation in anorexia nervosa. Clinical Psychology & Psychotherapy, 16(4), 348-356.

Hull, L., Petrides, K., & Mandy, W. (2020). The Female Autism Phenotype and Camouflaging: a Narrative Review. *Review Journal of Autism and Developmental Disorders, 8*, 306–317.

IBM Corp. (2020). IBM SPSS Statistics for Windows. *Version 27.0*. Armonk, NY: IBM Corp.

Karjalainen, L., Råstam, M., Paulson-Karlsson, G., & Wentz, E. (2019). Do autism spectrum disorder and anorexia nervosa have some eating disturbances in common? *European Child & Adolescent Psychiatry*, 69-78. doi:10.1007/s00787-018-1188-y

Kerr-Gaffney, J., Harrison, A., & Tchanturia, K. (2020). Autism spectrum disorder traits are associated with empathic abilities in adults with anorexia nervosa. *Journal of Affective Disorders, 266*, 273-281.

Kerr-Gaffney, J., Mason, L., Jones, E., Hayward, H., Ahmad, J., Harrison, A., . . . Tchanturia, K. (2020). Emotion Recognition Abilities in Adults with Anorexia Nervosa are Associated with Autistic Traits. *Journal of Clinical Medicine, 9*(1057).

Kinnaird, E., & Tchanturia, K. (2021). Looking beneath the surface: Distinguishing between common features in autism and anorexia nervosa. *Journal of Behavioral and Cognitive Therapy, 31*, 3-13.

Lai, M.-C., Lombardo, M. V., & Baron-Cohen, S. (2014). Autism. The Lancet, 838(9920), 896-910.

Laghi, F., Pompili, S., Zanna, V., Castiglioni, M. C., Criscuolo, M., Chianello, I., . . . Baiocco, R. (2015). Are adolescents with anorexia nervosa better at reading minds? *Cognitive Neuropsychiatry, 12*(6), 489-501.

Laghi, F., Pompili, S., Bianchi, D., Antonia, Lonigro, & Baiocco, R. (2020). Drunkorexia: An Examination of the Role of Theory of Mind and Emotional Awareness among Adolescents. *Developmental Neuropsychology,* 70-81. doi:10.1080/87565641.2020.1869743

Leslie, M., Halls, D., Leppanen, J., Sedgewick, F., Smith, K., Hayward, H., . . . Tchanturia, K. (2020). Neural Correlates of Theory of Mind Are Preserved in Young Women With Anorexia Nervosa. *Frontiers in Psychology*, *11*. doi: https://doi.org/10.3389/fpsyg.2020.568073

Lombardo, M. V., Barnes, J. L., Wheelwright, S. J., & Baron-Cohen, S. (2007). Self-referential cognition and empathy in autism. *PloS one*, *2*(9), e883.

Lord, C., Brugha, T., Charman, T., Cusack, J., Dumas, G., Frazier, T., . . . al, e. (2020). Autism spectrum disorder. *Nature reviews Disease primers, 6*(1).

Moree, B. N., & Davis, T. E. (2010). Cognitive-behavioral therapy for anxiety in children diagnosed with autism spectrum disorders: Modification trends. *Research in Autism Spectrum Disorders*, *4*(3), 346-354.

Nalbant, K., Kalaycı, B. M., Akdemir, D., Akgül, S., & Kanbur, N. (2019). Emotion regulation, emotion recognition, and empathy in adolescents with anorexia nervosa. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*, *24*, 825–834.

Noetel, M., Miskovic-Wheatley, J., Crosby, R. D., Hay, P., Madden, S., & Touyz, S. (2016). A clinical profile of compulsive exercise in adolescent inpatients with anorexia nervosa. *Journal of Eating Disorders, 4*(1). doi:10.1186/s40337-016-0090-6

Peres, V., Corcos, M., Robin, M., & Pham-Scottez, A. (2020). Emotional intelligence, empathy and alexithymia in anorexia nervosa during adolescence. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*, 1-8. doi:doi.org/10.1007/s4051

Pedreño, C., Pousa, E., Navarro, J. B., Pàmias, M., & Obiols, J. E. (2017). Exploring the Components of Advanced Theory of Mind in Autism Spectrum Disorder. *Journal of Autism and Developmental Disorders, 47*, 2401–2409.

Postorino, V., Scahill, L., Peppo, L. D., Fatta, L. M., Zanna, V., Castiglioni, M. C., . . . Mazzone, L. (2017). Investigation of Autism Spectrum Disorder and Autistic Traits in an Adolescent Sample with Anorexia Nervosa. *Journal of Autism and Developmental Disorders, 47*(4), 1051-1061. doi:10.1007/s10803-016-3023-y

Pooni, J., Ninteman, A., Bryant-Waugh, R., Nicholls, D., & Mandy, W. (2012). Investigating autism spectrum disorder and autistic traits in early onset eating disorder. *International Journal of Eating Disorders, 45*(4), 583-591.

Qualtrics. (2020). Qualtrics. Retrieved 2020, from Qualtrics: https://www.qualtrics.com

Reaven, J., & Hepburn, S. (2003). Cognitive-behavioral treatment of obsessive–compulsive disorder in a child with Asperger syndrome: A case report. *Autism, 7*, 145-164.

Redondoa, I., & Herrero-Fernández, D. (2018). Validation of the Reading the Mind in the Eyes Test in a healthy Spanish sample and women with anorexia nervosa. *Cognitive Neuropsychiatry*. doi:10.1080/13546805.2018.1461618

Rotheram-Fuller, E., & MacMullen, L. (2011). Cognitive-behavioral therapy for children with autism spectrum disorders. *Psychology in the Schools, 48*(3), 263-271.

Sampaio, F. T., Soneira, S., Aulicino, A., Martese, G., Iturry, M., & Allegri, R. F. (2013). Theory of mind and central coherence in eating disorders: Two sides of the same coin? *Psychiatry Research, 3*, 1116-1122.

Sedgewick, F., Leppanen, J., Goh, F., Hayward, H., Happé, F., & Tchanturia, K. (2019). Similarities and Differences in Theory of Mind Responses of Patients With Anorexia Nervosa With and Without Autistic Features. *Frontiers in Psychiatry*, *10*. doi:10.3389/fpsyt.2019.00318

Seitz, J., Konrad, K., & Herpertz-Dahlmann, B. (2018). Extend, Pathomechanism and Clinical Consequences of Brain Volume Changes in Anorexia Nervosa. Current Neuropharmacology, 16(8), 1164–1173. doi:10.2174/1570159X15666171109145651

Sfärlea, A., Greimel, E., Platt, B., Dieler, A. C., & Schulte-Körne, G. (2018). Recognition of emotional facial expressions in adolescents with anorexia nervosa and adolescents with major depression. *Psychiatry research*, *262*, 586-594.

Sifneos, P. E. (1973). The prevalence of 'Alexithymic' characteristics in psychosomatic patients. *22*(2-6), 55–262.

Strigo, I. A., Matthews, S. C., Simmons, A. N., Oberndorfer, T., Klabunde, M., Reinhardt, L. E., & Kaye, W. H. (2013). Altered insula activation during pain anticipation in individuals recovered from anorexia nervosa: evidence of interoceptive dysregulation. *International Journal of Eatign Disorders, 46*(1), 23–33.

Tella, M. D., Adenzato, M., Catmur, C., Miti, F., Castelli, L., & Ardito, R. B. (2020). The role of alexithymia in social cognition: Evidence from a non-clinical population. *Journal of Affective Disorders, 273*, 482-492.

Treasure, J., & Schmidt, U. (2013). The cognitive-interpersonal maintenance model of anorexia nervosa revisited: a summary of the evidence for cognitive, socio-emotional and interpersonal predisposing and perpetuating factors. *Journal of Eating Disorders*, 1-13.

Tonacci, A., Calderoni, S., Maestro, L. B., Fantozzi, P., FedericaCiuccoli, Morales, M. A., . . . Muratori, F. (2019). Autistic traits impact on olfactory processing in adolescent girls with Anorexia Nervosa restricting type. *Psychiatry Research, 274*, 20-26.

Vellante, M., Baron-Cohen, S., Melis, M., Marrone, M., Petretto, D. R., Masala, C., & Preti, A. (2013). The "Reading the Mind in the Eyes" test: Systematic review of psychometric properties and a validation study in Italy. *Cognitive Neuropsychiatry, 18*(4), 326–354. doi:10.1080/13546805.2012.721728

Westwood, H., Eisler, I., Mandy, W., Leppanen, J., Treasure, J., & Tchanturia, K. (2016). Using the Autism-Spectrum Quotient to Measure Autistic Traits in Anorexia Nervosa: A Systematic Review and Meta-Analysis. *Journal of Autism and Developmental Disorders, 46*(3), 964-77.

Westwood, H., Kerr-Gaffney, J., Stahl, D., & Tchanturia, K. (2017). Alexithymia in eating disorders: Systematic review and meta-analyses of studies using the Toronto Alexithymia Scale. *Journal of Psychosomatic Research, 99*, 66-81.

Westwood, H., & Tchanturia, K. (2017). Autism Spectrum Disorder in Anorexia Nervosa: An Updated Literature Review. *Current Psychiatry Reports, 7*(41).

Westwood, H., Stahl, D., Mandy, W., & Tchanturia, K. (2016). The set-shifting profiles of anorexia nervosa and autism spectrum disorder using the Wisconsin Card Sorting Test: a systematic review and meta-analysis. *Psychological Medicine*, *46*, 1809–1827. doi:doi:10.1017/S0033291716000581

Westwood, H., Mandy, W., Simic, M., & Tchanturia, K. (2018). Assessing ASD in Adolescent Females with Anorexia Nervosa using Clinical and Developmental Measures: a Preliminary Investigation. *Journal of Abnormal Child Psychology, 46*(1), 183–192.

Westwood, H., Mandy, W., & Tchanturia, K. (2017). Clinical evaluation of autistic symptoms in women with anorexia nervosa. *Molecular Autism, 8*(12). doi:10.1186/s13229-017-0128-x

Westwood, H., Mandy, W., & Tchanturia, K. (2017). The association between symptoms of autism and neuropsychological performance in females with Anorexia Nervosa. *Psychiatry Research, 258*, 531-537.

Wheelwright, S., Auyeung, B., Allison, C., & Baron-Cohen, S. (2010). Defining the broader, medium and narrow autism phenotype among parents using the Autism Spectrum Quotient (AQ). *Molecular autism, 1*(1), 1-9.

Section Four: Empirical Research Study Supplementary Chapters

Methodology

Research Context

The research was supported by the HSE National Clinical Programme for Eating Disorders and the two eating disorder teams currently operating under the programme. Eating disorder teams were based in Cork and Dublin. Both teams provide services to around approximately 50 clients that have AN, however, these numbers vary continuously.

Research Development Process

The idea for the research developed from a review of the prior literature examining a potential link between AN and ASD (Treasure & Schmidt, 2013; Westwood & Tchanturia, 2017). Avenues for research pertaining to social and emotional cognition in AN were then discussed with the academic supervisor, where research questions were focused and refined. Additional discussions focused on the development of the research methodology, data collection instruments and strategies for recruitment.

Subsequently, two specialist child and adolescent eating disorder teams in the community were approached. Both teams expressed an interest in facilitating the research, where meetings with Senior Psychologists and Consultant Psychiatrists on respective teams yielded useful information which further informed the research methodology.

Ethical approval was sought from the UCC Clinical Psychology Research Ethics Committee. Feedback from this process requested further elaboration on the research methodology. Following amendments, the application was approved and data collection with the Cork specialist eating disorder team commenced. Following this, schools in the community were approached to participate. To collect data with the Dublin specialist eating disorder team a separate ethics application was made. This review process yielded minor amendments and was approved once changes were incorporated.

Prior to beginning data collection, the researcher presented the research protocol to both teams. Following this, services were provided with materials for data collection with the AN cohort.

Throughout the research, there were regular academic supervision meetings and consultations with research partners to monitor progress. This also served as an opportunity to plan contingencies in response to research and external developments. This proved a valuable exercise and allowed for planning around the difficulties in response to COVID-19.

As part of the original data collection procedure with the healthy control group, it had been planned that the researcher would attend the school in person and administer hard copies of the questionnaires to students. Due to COVID-19, this was deemed an unnecessary risk. Through discussion with the academic supervisor, an alternative plan for data collection was developed. This involved the digitisation of the data collection process with this group through an online questionnaire. This adaptation to the methodology was subsequently approved through an ethical amendment submission which then allowed for the data collection with this group.

Regular contact with specialist eating disorder teams was maintained throughout the data collection period to ensure they had adequate materials and to support around any difficulties encountered. This was further supported through the researcher being on clinical placement with the Dublin based specialist eating disorder service.

Data Collection Procedure

AN Group

Patient data is collected as part of routine clinical practice from young people attending specialist eating disorder teams. This is generally performed at admission to the service, six weeks after admission, at six months, 12 months and at discharge. It is as part of these routine clinical data collection procedures participants were generally invited to participate. Individuals attending the service not due for review were also invited to participate.

The parents/guardians of AN participants were informed of the study through clinicians in the service and through an information sheet with details of the study. This was typically done at the same time intake or review questionnaires were being administered as part of the services routine clinical practice. Parents were provided with a research questionnaire pack, including a parental consent form and an information sheet and assent form for young people. The questionnaire pack also included research questionnaires for the young person to complete if they agreed to participate. Participants sometimes completed the questionnaires in the clinic, but generally they were taken home to be completed.

The parents/guardians of young people who had consented to be contacted for research purposes were also provided with a questionnaire pack through the post. These packs contained information sheets, consent/assent forms, research questionnaires, in addition to the eating disorder and mental health-related questionnaires used as part of the review process for the service. A debrief form signposting additional community supports for parents/guardians and young people was also included with all questionnaire packs; this was in addition to a stamp returned envelope to facilitate the return of completed questionnaires.

Data collected in the AN group specifically pertained to demographic information, illness-related data (i.e. BMI, time since referral), eating disorder symptomatology and a screening instrument for mental health difficulties. Research specific questionnaires collected data measuring ASD traits and social and emotional functioning. Data was collected in the AN group between June 2020 and March 2021.

Healthy Control Group

A number of second-level schools in the community were approached through email to help facilitate the research. One community school in Cork agreed to facilitate their transition students participation. The healthy control group was invited to participate through an

information sheet and consent form distributed to the parents/guardians of students by the transition year headteacher. Once parents indicated consent, students were provided with information on the study. Students were required to indicate their assent to participation digitally before being linked to the questionnaires. The questionnaires were administered to this group through Qualtrics (2020) in their computer class.

Participants were requested to provide demographic information and details on their weight and height to facilitate the calculation of BMI/%W4H. Unlike the AN group, the healthy control sample were not administered eating disorder related or mental health questionnaires. This was intending to avoid any distress that may have arisen in response to questions that may have been triggering for young people not already in receipt of support. Healthy control participants were also provided with a debriefing form that contained information on mental health support services in the community. Data from the healthy control group were collected in November and December 2020.

Data Collection Instruments

Demographic Information

All participants were asked to provide information on their gender, age, ethnicity and if they had a diagnosis of ASD. Participants in the AN groups consented to the service to provide information pertaining to their BMI/%WFH and their date of admission to the service.

AN and Healthy Control Questionnaires

Autism-Spectrum Quotient

The Autism-Spectrum Quotient (AQ) is a 50-item self-report measure of ASD traits (Baron-Cohen et al., 2001; see Appendix 13). It is a widely used ASD screening tool and has been employed in research assessing ASD traits among various clinical groups (Cath et al., 2008; Wouters & Spekb, 2011). It has also seen considerable use in studies assessing ASD traits in

both child and adult AN samples (Baron-Cohen et al., 2013; Karjalainen et al., 2019; Westwood et al., 2016). Each question requires the individual to indicate their level of agreement with a statement (e.g. "I tend to notice details that others do not", "I frequently find that I don't know how to keep a conversation going") where they are given four response options; 'definitely agree,' 'slightly agree,' 'slightly disagree,' or 'definitely disagree'. Although there are four options, the maximum response score is one which is assigned with the two responses that are positively associated with ASD traits. The maximum score is 50. For the total scale, a score over 32 is considered suggestive of ASD, while a score between 23-28 is categorised as the BAP (Baron-Cohen et al., 2001; Wheelwright et al., 2010). For reference, a mean score of 16.4 (6.3) for a large sample of neurotypical adults, and 35.8 (6.5) for a sample of adults with Asperger's Syndrome/High Functioning Autism were reported as part of the development of the scale (Baron-Cohen et al., 2001). The AQ also yields five subscales; Social Skills, Attention Switching, Attention to Detail, Communication and Imagination.

Through the original validation study, the AQ was reported to have good test-retest reliability and discriminant validity in identifying the presence of ASD (Baron-Cohen et al., 2001). Through the initial validation study Cronbach's alpha coefficients were moderate to good (Communication $\alpha = 0.65$; Social $\alpha = 0.77$; Imagination $\alpha = 0.65$; Attention to detail $\alpha = 0.63$; Attention Switching $\alpha = 0.67$). Approximate Cronbach's alpha scores have been reported in subsequent studies with neurotypical adults (Stevenson & Hart, 2017). The AQ's subscales however, have not been adequately replicated in factor-analytic studies (Kloosterman et al., 2011; Stewart & Austin, 2009). Notwithstanding this, the AQ has also been reported to display good convergent validity with other ASD screening instruments such as the Social Responsiveness Scale (Armstrong & Iarocci, 2013).

The Reading of the Mind in the Eyes Test

The Reading of the Mind in the Eyes Test (RMET) assesses an individual's ability to identify a complex emotional and mental state in others and is used as a measure of ToM (Baron-Cohen et al., 2001; see Appendix 14). Examinees are presented with 36 black and white images of the eye region of a person's face with four response choices of different emotions or mental states offered. The individual is required to identify the word best describing what emotion is represented in the picture. Correct scores are marked 1, incorrect scores are marked 0 and the maximum score is 36. In the development of the measure, the previously published mean score for the RMET for a healthy control adult sample was 26.2 (3.6). This score was 21.9 (6.6) for an Asperger's Syndrome/High Functioning Autism sample (Baron-Cohen et al., 2001).

The RMET has good test-retest reliability and has been reported to have good convergent validity with other measures of ToM. However, prior studies have reported low internal consistency with a Cronbach's alpha of 0.60 reported (Vellante et al., 2013). Factor analysis has indicated that it does exhibit a single factor solution (Olderbak et al., 2015). The RMET has also been reported to demonstrate good discriminant ability between individuals with ASD and healthy controls when assessing for ToM (Baron-Cohen et al., 2015).

Toronto Alexithymia Scale-20

The 20-item Toronto Alexithymia Scale (TAS-20) is a self-report measure of alexithymia (Bagby, Taylor, et al., 1994; see Appendix 15). The TAS-20 provides a Total score and scores for three subscales; Difficulty Identifying Feelings (e.g. I am often confused about what emotion I am feeling); Difficulty Describing Feelings (e.g. It is difficult for me to find the right words for my feelings) and Externally Orientated Thinking (e.g. I prefer talking to people about their daily activities rather than their feelings). The TAS-20 requires individuals to indicate to what extent they agree or disagree with statements through a five-point Likert scale. Total scores range from 20 to 100, where higher scores are indicative of increased levels of

alexithymia. Scores above 60 are indicative of alexithymia, between 51 and 60 are considered borderline, while scores 50 or below are deemed in the normal range (Lombardo et al., 2007).

The TAS-20 has seen considerable use in several different countries, across clinical and general research contexts, as well as among adolescents (Kooiman et al., 2002; Säkkinen et al., 2007). It has demonstrated good test-retest reliability and good to acceptable internal consistency in the original validation study (TAS Total α = 0.81; Difficulty Identifying Feelings α = 0.78; Difficulty Describing Feelings α = 0.75; Externally Orientated Thinking α = 0.66; Bagby, Parker, et al. 1994). It has been negatively associated with measures of psychological mindedness (Bagby et al. 2020). The three-factor structure TAS-20 has also been supported among adolescent samples (Bagby et al., 1994; Torres et al., 2019).

The Interpersonal Reactivity Index

The Interpersonal Reactivity Index (IRI) is one of the most commonly used measures of empathy (Davis, 1980; see Appendix 6). It is a 28-item self-report measure with a five-point Likert style response system that requires the individual to indicate the extent to which it a statement describes them. IRI assumes that empathy is made up of four related, but conceptually distinct constructs which make up its four subscales; Perspective Taking, Fantasy, Empathic Concern, and Personal Distress (Calderoni et al., 2013). The Perspective Taking scale refers to a person's ability to adopt another's point of view. The Fantasy scale assesses an individual's capacity to imagine themselves in fictional situations such as in the scene of a movie, or as a character in a book. Empathetic Concern pertains to the extent to which a person tends to sympathise with another. The Personal Distress subscale considers an individual's tendency to experience discomfort in response to stressful situations or another's experience of distress. These subscales can also yield both a cognitive empathy score (Perspective Taking and Fantasy) and an affective empathy score (Empathic Concern and Personal Distress; Stocks & Lishner, 2012). Although the two-scale interpretation is common within published literature,

factor analytic studies have indicated a poor model of fit for this two-factor structure and encourage the use of the original four-factor model (Chrysikou & Thompson, 2016).

The IRI has demonstrated good psychometric properties, acceptable test-retest reliability and acceptable internal consistency as reported through the original validation study (Davis, 1980). It has also been utilised in different countries and in research with both clinical and general populations, including AN (Guan & Qian, 2014; Hawk et al., 2013; Nalbant et al., 2019). The IRI has also demonstrated good concurrent validity with other measures of empathy (Davis, 1980; Guan & Qian, 2014; Hawk et al., 2013). Through use in research with adolescents, it has demonstrated acceptable to good internal consistency across subscales with Cronbach's alpha levels ranging between 0.67-0.87 reported (Hawk et al., 2013).

AN Group Data Collection Measures

Eating Disorder Examination Questionnaire- Adolescent

The Eating Disorder Examination Questionnaire - Adolescent (EDEQ-A) (Carter et al, 2001; see Appendix 7) is a 36-item self-report instrument that measures the severity of eating disorder symptoms in the 14 days prior to completing the questionnaire. The EDEQ-A is an adapted version of the adult Eating Disorder Examination Questionnaire (fourth edition; Fairburn & Beglin, 1994). Adaptions from the original include assessing for eating disorder symptoms in the last 14 days as opposed to 28 and the simplification of language.

The EDEQ-A utilises a seven-point Likert style response option that indicates the occurrence and frequency of eating disorder behaviours. The EDEQ-A generates a Total score which gives an overall illness severity. It also provides four subscales; Dietary Restraint considers the extent to which one is limiting their intake; Weight Concern relates to the level of preoccupation with weight and losing weight; Shape Concern examines the extent to which someone is focused on their shape and the associated impact of food on same, and Eating Concern assesses thinking

relating to calories, fear of losing control eating and food-related guilt. Similarly to the Total scale, higher scores indicate more indicated increased difficulties in subscale areas. Higher scores indicate more eating disorder difficulties where the maximum is six on all scales.

The adult version of the EDEQ-A has received support for its internal consistency, test-retest reliability, convergent validity and its ability to distinguish between clinical populations and community samples (Aardoom et al., 2012; Bardone-Cone & Boyd, 2007; Berg et al., 2012). There is less research examining the properties of the adolescent version, that which has been conducted has indicated good internal consistency with a Cronbach's alpha of 0.96 for the Total score and alpha levels ranging from 0.77 - 0.94 for subscale scores. Confirmatory factor analysis has however failed to support the four-factor model in adolescents. Subsequent exploratory factor analysis indicated that a dissatisfaction with shape and weight was reported to act as a sole underlying factor in young adolescent girls in both clinical and general population. The same analysis indicated a three-factor loading structure for males; weight-related concerns, body discomfort and restraint (Forsen Mantilla, et al., 2017). Due to being provided with summary scores on this measure, reliability analyses could not be performed in the present sample.

Eating Disorder Flexibility Index

The Eating Disorder Flexibility Index (EDFLIX) is a self-report measure of cognitive, behavioural and eating related rigidity in eating disorders (Dahlgren et al., 2019; see Appendix 8). The 36-item questionnaire requires individuals to indicate on a six-point Likert type scale ("strongly disagree" to "strongly agree") the extent to which a statement applies to them. The EDFLIX provides a total flexibility score (EDFLIX-Tot); a general flexibility scale (EDFLIX-GF; e.g. If I have to, it's easy for me to change my plans); and subscales relating to food and exercise (EDFLIX-FoEx; e.g. I prefer eating the same foods as I usually do); and weight and shape (EDFLIX-WeSh; e.g. I get distressed if I gain weight, no matter what I weigh). Higher

scores indicate higher levels of flexibility; however, the scale does not provide interpretive categories.

The EDFLIX demonstrated good psychometric properties through its original validation which reported a Cronbach's alpha of 0.91 for the EDFLIX-Tot and EDFLIX-GF scales. A Cronbach's alpha of 0.83 was reported for the EDFLIX-WeSh subscale and an alpha level of 0.76 for the EDFLIX-FoEx subscales. The EDFLIX has good construct validity and has demonstrated its usefulness in discriminating between individuals with eating disorders and the general population; it has also demonstrated its ability to differentiate between specific eating disorders. The EDFLIX has seen limited use in published research to date. To the author's knowledge, this will be the first study to utilise the measure with adolescents. Similarly to the EDEQ-A, due only summary scores on this measure were provided and therefore reliability analyses could not be performed.

Revised Children's Anxiety and Depression Scale

The Revised Children's Anxiety and Depression Scale (RCADS; see Appendix 9) is a 47-item self-report mental health screening questionnaire. The RCADS is widely used and recommended as a routine clinical assessment measure (Chorpita et al., 2000; Child Outcomes Research Consortium, 2021). The RCADS utilises a four-point Likert style response option that requires the individual to indicate the frequency ranging from "never" to "always" to which a statement applies to them (e.g. I worry that bad things will happen to me). The RCADS contains six subscales developed to correspond with DSM-IV diagnostic categories; Major Depressive Disorder, Generalised Anxiety Disorder, Separation Anxiety Disorder, Panic Disorder, Social Phobia and Obsessive-Compulsive Disorder (OCD). It also provides a Total Anxiety score and a Total Anxiety and Depression consisting of all six subscales. The RCADS provides t-scores for each measure which are normed to the individual's age. T-scores above

65 are generally considered within the borderline range, with scores over 70 deemed in the clinical range (Chorpita et al, 2000).

The RCADS has been heavily utilised in a variety of clinical and general population settings with individuals with AN where it has demonstrated robust internal consistency and reliability (Noetel et al., 2016; Piqueras et al., 2017). The RCADS has also been studied in an Irish context where its factor structure has been confirmed, its convergent validity with other measures of depression and anxiety has also been demonstrated (Donnelly et al., 2019). It is also reported to demonstrate good to adequate internal consistency in an Irish context also (Total Anxiety and Depression α = 0.96; Total Anxiety α = 0.95; Major Depressive Disorder α = 0.88; Generalised Anxiety Disorder α =0.88; Separation Anxiety Disorder α =0.69; Social Phobia α = 0.86; Panic Disorder α =0.84; OCD α = 0.78).

Data Analysis

Data Cleansing

Data from the AN group was manually scored and input into the data file. Data from the healthy control group was downloaded from data collection software and added to the data file. Overall there were 153 participant responses. Upon closer investigation, it was observed that a number of these were incomplete responses. Twelve participants in the healthy control sample were initially excluded as they did not progress past the demographic questions or complete at least one questionnaire. One person within the healthy control sample reported having a diagnosis of ASD. In order to avoid confounding within the healthy control group, this participant was removed from the sample. Although there was a person in the AN group with a diagnosis of ASD, as diagnoses of ASD among people with AN is common (Westwood et al., 2018), the decision not to exclude this participant was made.

A missing data analysis was then performed on the responses of the remaining 140 participants using the MICE package through R (R Core Team, 2020; van Buuren & Groothuis-Oudshoorn, 2011). A single imputation approach was utilised for missing data; this technique replaces missing values with predicted scores from a regression equation based on the other participant responses. Imputation could not be performed on the eating disorder or mental health specific questionnaire responses within the AN group due to having access only to participant summary scores.

For the AQ there were 110 complete cases with no data missing. The remaining 30 cases had between one and three items missing for which data was then imputed. This resulted in 27 responses on the AQ for the AN group and 113 for the healthy control sample. On the RMET there were 120 completed responses. Between one to four responses were missing for eight participants for which imputation was performed. The remaining 12 participants had omitted more than eight responses and were excluded from the imputation. Following imputation, there were 128 complete cases for the RMET. Twenty-seven participants in the AN group were included in the analysis. All excluded cases were in the healthy control group which resulted in 101 participants from this group being included in the analysis.

There were 132 complete cases for the TAS-20. Three participants had between 16-20 items missing and were excluded from the imputation. Imputation was performed with the remaining cases where three or fewer responses were missing. Of the 137 responses on the TAS-20 26 were AN participants and 111 belonged to the healthy control group. On the IRI there were 118 complete responses. Nine cases with more than three missing items were removed. Imputation was performed on the remaining cases with three or fewer missing responses. There were 26 AN and 105 healthy control participants included in the final analysis.

In the AN group, summary scores on the EDEQ-A were unavailable for two respondents. Three participants in this group did not complete the EDFLIX. Five AN participant summary scores on the RCADS were also not available.

Analytic Strategy

Preliminary data analyses involved conducting descriptive analyses to provide information about the sample and data provided through the questionnaires. Analyses were conducted using SPSS (IBM Corp, 2020). Measures being utilised for inferential statistics were assessed for normality at a group level and within each participant group. On the overall measures and subscales, skewness and kurtosis were all within acceptable ranges, and histograms were also inspected for symmetry where they were observed to assume normal distributions. This was with the exception of the Empathetic Concern subscale of the IRI for the AN group that did not assume a normal distribution. Due to control participants all being drawn from a transition year sample the age of this group did not assume a normal distribution.

Reliability analyses were conducted using Cronbach's alpha (1951) to assess the levels of internal consistency for data collection instruments (AQ, RMET, TAS-20, IRI) and respective subscales. This was performed for both the AN and healthy control group where alpha scores above .70 were considered good. For subscales with a smaller number of items, alpha statistics below .70 were deemed acceptable where they were in line with prior literature (Pallant, 2012).

The AN and healthy control group were compared across dependent variables using one-tailed independent samples t-tests for data that assumed normal distributions. Bonferroni corrections were applied where multiple comparisons were performed. These corrections were applied by multiplying the observed *p*-value by the number of tests conducted for each measure (Bland & Altman, 1995). For variables with a non-normal distribution, a one-tailed Mann-Whitney U

test was utilised for comparisons. For group comparison analyses, statistical significance was assumed at the $p<0.05$ and $p<.01$ levels.

Within the AN group specifically, correlation analyses were performed to explore the relationships between variables (%WFH, AQ, RMET, TAS, IRI subscales, EDE-A, EDFLIX, and RCADS Total Anxiety and Depression subscale). Correlation analyses were performed using a two-tailed Pearson's correlation coefficient to explore the relationships between variables where significance was assumed at $p<.05$ and $p<.01$ levels. Where correlations were significant the data was then visualised on scatter plots.

Results

Participant Demographics

An overview of participant characteristics and associated group comparisons can be seen in Table 1. The overall sample was predominantly white (96%).

Ten individuals were recruited within the AN group as part of the intake process to the specialist eating disorder service. Five participants were recruited at their six-week review, two at their six-month review, one at discharge. Nine AN participants were recruited outside of the review process. The healthy sample made up the remaining participants. Data collection for the control group was facilitated through their school during November and December 2020.

The mean %W4H for the overall AN group was 92.59% (*SD*=10.16%). The mean BMI was 18.91kg/m^2 (*SD*=2.22kg/m^2). The mean %W4H for the AN-R group was 89.72% (*SD*=1.5), and mean BMI of 18.3kg/m^2 (*SD*=1.39). This is considered a significantly low weight (APA, 2013). In the ATAN group, the %W4H was 114.51% (*SD*=7.9) and BMI of and 23.53kg/m^2 (*SD*=2.01). Naturally, the ATAN this group were not underweight. In the healthy control sample, 72 participants provided data to allow their %W4H and BMI to be calculated. The mean %W4H for this group was 105.39% (*SD*=13.93), and the mean BMI was 21.06 kg/m^2 (*SD*=2.77), which is considered in a normal range.

AQ

When considering results on this measure, higher AQ Total and subscale means indicate higher ASD traits. For the AN group, the AQ Total mean was higher than the healthy control group (see Table 2).

Table 1. *Demographic Information*

Group	**AN (*N*=27)**			**HC (*N*=113)**			**Group comparison**			
	n	***M***	***SD***	***n***	***M***	***SD***	***t***	***df***	**MWU**	***p*-value**
Age	27	15.52	1.6	112	15.77	0.42			1455	.711
%Female	77.8%			50.4%						
%W4H	26	92.59%	10.16	72	105.39	13.93	4.28	96		.001**
AN-R	23	89.72%	1.5		105.39	13.93	7.5	83.83		.001**
ATAN	3	114.51%	7.9		105.39	13.93	-1.12	73		.266
BMI kg/m^2	26	18.91	2.22	72	21.06	2.77	3.55	96		.001**
AN-R	23	18.3	1.39		21.06	2.77	6.3	75.65		.001**
ATAN	3	23.57	2.01		21.06	2.77	-1.5	73		.12
Weeks since admission	26	24	32	-	-	-	-	-		-

AN = Anorexia Nervosa, AN-R =Anorexia Nervosa -Restricting Type, ATAN = Atypical Anorexia Nervosa, HC = Healthy Controls, MWU= Mann-Whitney U

**Denotes significance at .05 level, ** denotes significance at .001 level*

To help situate the present results, both group mean scores across the AQ are considered with reference to a large neurotypical sample of adults and cohort of adults with Asperger's Syndrome/High Functioning Autism (Baron-Cohen et al. 2001). Both groups had considerably higher total mean scores when compared to a large sample of neurotypical adults (N=174; M=16.4; SD=6.3). However, the present AQ Total mean scores were lower than those reported in the same study for a sample of adults with Asperger's Syndrome/High Functioning Autism (N=58; M=35.8; SD=6.5).

The mean scores for both groups were below the threshold of the BAP (23≤; Wheelwright et al., 2010), and the cut off considered indicative of ASD (32≤; Baron-Cohen et al. 2001). Frequency analysis indicated that 33.3% (n=11) of the AN group had AQ scores above the threshold of the BAP. Three (11.11%) of these participants were above the AQ Total score threshold indicative of ASD. Within the healthy control group, 22.1% (n=30) of the sample scored above the BAP threshold and one person (.88%) scored above the threshold indicative of ASD.

For the Social Skills subscale, the AN group had a higher mean score than the healthy control group. This indicates that the AN groups experience more social difficulties consistent with ASD than the control group. Comparison with a previously published healthy adult mean (M=2.6; SD=2.3) indicates that the AN group mean was higher than those previously reported. The present healthy control group mean score was similar to referenced healthy control mean. Both the AN group and healthy control group mean scores were considerably lower than the Asperger's Syndrome/High Functioning Autism sample (M=7.5; SD=1.9).

The mean score for the AN group on the Attention Switching subscale was higher than the mean of the healthy control group. Observation of mean scores signifies that the AN group

experience more difficulties in shifting their attention between tasks. Comparison with previous research indicates that both means in the present sample are higher than those previously reported with neurotypical adults (*M*=3.9; *SD*=1.9) but lower than those reported for the Asperger's Syndrome/High Functioning Autism sample (*M*=8; *SD*=1.8).

The AN group mean score on the Attention to Detail subscale was marginally higher than the healthy control group. These scores were slightly higher than the means reported for neurotypical adults (*M*=5.3; *SD*=2.3) and lower than those reported for an Asperger's Syndrome/High Functioning Autism sample (*M*=6.7; *SD*=2.3). Consideration of mean scores with reference to the present and referenced healthy control groups indicate that the AN sample do not report increased traits consistent with ASD with regard to Attention to Detail.

For the Communication subscale, the mean score for the AN group was slightly higher than the healthy control group. Both groups mean scores on the Communication scale were higher than those previously reported in a neurotypical control group (*M*=2.4; *SD*=1.9) and lower than those reported for a sample with Asperger's Syndrome/High Functioning Autism (*M*=7.2; *SD*=2). Observation of mean scores signifies that the AN group experience more communication difficulties consistent with ASD than the present or referenced healthy control groups.

Table 2. *Participant Mean Scores*

	AN				HC			
	α	***n***	***M***	***SD***	***α***	***n***	***M***	***SD***
AQ Total	.79	27	21.11	6.89	.66	113	19.12	5.4
Social skills	.75		3.56	2.67	.61		2.53	2
Attention switching	.66		5.89	2.29	.46		4.81	1.93
Attention to detail	.69		5.59	2.46	.49		5.50	2.01
Communication	.35		3.67	1.79	.49		3.42	1.94
Imagination	.32		2.41	1.60	.42		2.85	1.79
RMET	.65	27	24.59	4.49	.73	101	21.60	5.30
TAS-20 Total	.71	26	61.69	9.12	.74	111	58.66	10.09
Difficulty identifying feelings	.81		22.31	5.78	.81		20.54	6.01
Difficulty describing feelings	.67		17.35	3.73	.67		16.03	4.12
Externally orientated thinking	.31		22.04	3.71	.54		22.09	4.66
IRI		26				105		
Perspective taking	.69		18.12	4.87	.72		15.99	5.12
Fantasy	.68		16.77	5.07	.74		17.72	5.69
Empathic concern	.52		18.65	3.58	.69		18.01	5.06
Personal distress	.75		15.81	4.86	.68		12.83	4.94

AN = Anorexia Nervosa, HC = Healthy Controls, AQ =Autism Quotient, RMET = Reading the Mind in The Eyes Task, TAS-20= Toronto Alexithymia Scale, IRI= Interpersonal Reactivity Index

Table 3. *Group Comparisons*

	AN - HC			
	t	***df***	***MWU***	***p***
AQ Total	-1.61	138		.32
Social skills	-2.22	138		.48
Attention switching	-2.50	138		.03*
Attention to detail	-.19	138		.99
Communication	-.59	138		.99
Imagination	1.17	138		.99
RMET	-2.67	126		.004**
TAS Total	-1.40	135		.32
Difficulty identifying feelings	-1.35	135		.32
Difficulty describing feelings	-1.49	135		.24
Externally orientated thinking	.053	135		.99
IRI				
Perspective taking	-1.91	129		.087
Fantasy	.78	129		.63
Empathic concern			1232.5	.22
Personal distress	-2.76	129		.0105*

AN = Anorexia Nervosa, HC = Healthy Controls, AQ =Autism Quotient, RMET = Reading the Mind in The Eyes Task, TAS-20= Toronto Alexithymia Scale, IRI= Interpersonal Reactivity Index MWU= Mann-Whitney U
**denotes significance at .05 level, ** denotes significance at .01 level*
Note: p-values corrected for multiple comparisons

The mean score on the Imagination subscale for the AN group was slightly lower than the mean observed for the healthy control sample. Reference to previously published mean scores indicate that both groups mean scores were marginally higher than those reported for neurotypical adults (*M*=2.3; *SD*=1.7) and lower than those reported for an Asperger's Syndrome/High Functioning Autism group (*M*=6.4; *SD*=2). This indicates that that the AN group do not report increased ASD traits with respect to imagination.

To test the hypothesis that the AN participant group have more ASD traits as measured by the AQ and subscales than the healthy control sample, both groups were compared across this measure using a one-tailed independent samples t-test (see Table 3). As multiple t-tests were performed, a Bonferroni correction was applied to observed *p*-values.

RMET

The mean score for the AN group was considerably higher than the healthy control group (see Table 2). When considering these means with reference to those previously published for the RMET, the AN group mean score was lower than that of a large sample of neurotypical adults recruited as part of the development of the measure (*N*=122; *M*=26.2; *SD*=3.6; Baron-Cohen et al., 2001). The present healthy control group had a similar mean score to that of an adult group with Asperger's Syndrome/High Functioning Autism (*N*=15; *M*=21.9; *SD*=6.6) in the aforementioned reference study. To test the hypothesis that the AN would group perform comparatively worse on the RMET task than the healthy control sample, both groups were compared using a two-tailed independent samples t-test (see Table 3).

TAS-20

Higher scores on this measure are indicative of more alexithymic traits or challenges with respect to the areas explicitly measured by subscales. The mean score for the AN group was

61.69 (*SD*=9.12) and within the alexithymic range (60<; Craparo et al., 2015). The mean score for the healthy control group was lower 58.66 (*SD*=10.09), and in the borderline alexithymic range (51-60; see Table 2). With respect to previously published results, the present mean scores for both groups were considerably higher than a sample of neurotypical adults (*N*=30; *M*=41.97; *SD*=9.19; Lombardo et al., 2007). The present AN group mean score was also higher than the mean reported for an adult group with Asperger's Syndrome/High Functioning Autism (*N*=30; *M*=58.37; *SD*=14.19). Lombardo et al. (2007) is referenced throughout the remaining social and emotional measures in this section as it is one of the larger studies containing both a healthy control and Asperger's Syndrome/High Functioning Autism group using the TAS-20 and IRI.

For the Difficulty Identifying Feelings subscale, the mean score for the AN group was higher than the healthy control group. These mean scores were both higher than those previously reported for both healthy adults (*M*=13.50; *SD*=4.82) and adults with Asperger's Syndrome/High Functioning Autism (*M*= 20.03; *SD*=6.70). On the Difficulty Describing Feelings subscale, the AN mean score was also higher than the mean in the control group. Both the AN and healthy control group means were higher than those previously reported for healthy adults (*M*=11.10; *SD*=4.85). For this subscale, only the AN group mean was higher than the mean score of the Asperger's Syndrome/High Functioning Autism reference group (*M*=16.87; *SD*=5.62). For the Externally Orientated Thinking subscale, the AN group mean was marginally lower than the mean of the healthy control group. Consideration of previously published means indicate that both mean scores were higher than those previously reported in neurotypical adults (*M*=17.37; *SD*=4.16) and Asperger's Syndrome/High Functioning Autism samples (*M*=21.47; *SD*=4.90).

To test if participants with AN report significantly more difficulties than the healthy control group on the TAS-20 and subscales a one-tailed independent samples t-test with a Bonferroni correction was used to compare these groups. Analysis indicated no significant difference between the AN and healthy control group for TAS-20 Total scores or subscales (see Table 3). When the means in the present study are considered with reference to the previously published means, it appears that both the AN and control groups have elevated alexithymic traits where they are either in-line or higher than mean scores for a sample of people with Asperger's Syndrome/High Functioning Autism. This caveats the between group comparisons on the TAS-20.

IRI

For the IRI, mean of four subscales for both groups were calculated (see Table 2). For the Perspective Taking subscale, higher scores are associated with an increased propensity to perspective take. The AN group mean for this scale was higher than the healthy control group. When considered with reference to previously published mean scores the AN group scores were similar to those of a healthy control group of adults 18.50 (*SD*=5.30). However, the healthy control group mean score within the present sample was closer to the mean score reported for the Asperger's Syndrome/High Functioning Autism cohort in the referenced study (*M*=14.33; *SD*=5.49).

Higher scores on the Fantasy subscale are associated with the tendency or ease of imagining oneself in another's position. On the Fantasy scale, the AN group mean was lower than the healthy control mean. Both mean scores were similar to those previously reported for healthy adults (*M*=17.77; *SD*=4.82) and higher than means reported for adults with Asperger's Syndrome/High Functioning Autism (*M*=13.87; *SD*=6.34).

Higher scores on the Empathic Concern subscale are associated with increased empathy for others. The mean Empathic Concern score was marginally higher in the AN group than in the healthy control group. The mean scores were similar in both groups to those previously reported for healthy adults (M=18.93; SD=5.16) and higher than adults with Asperger's Syndrome/High Functioning Autism (M= 15.83; SD=6.09).

The Personal Distress scale relates to the amount of stress experienced by a person in an emergency or emotionally challenging situations. Higher scores are associated with increased distress. The AN group mean score was considerably higher than the healthy control group mean score on this scale. When considered in relation to previously reported means, the AN group mean was higher than the healthy adult control group mean (M=10.60; SD=4.0) and the Asperger's Syndrome/High Functioning Autism group mean (M=14.53; SD=5.42). The healthy control group mean in the present sample represented an approximate mid-point between the two group reference means.

To test if participants with AN report more difficulties than the healthy control group on the IRI subscales a one-tailed independent samples t-test with a Bonferroni correction was used (see Table 3). This was with the exception of the Empathetic Concern subscale as this was not normally distributed; therefore, a Mann-Whitney U test was utilised.

Results indicated no differences between groups on the Perspective Taking subscale, no differences between groups on the Fantasy subscale, and no differences between groups on the Empathetic Concern subscale. A group difference was observed on the Personal Distress subscale (t=-1.91; df=129; p<.05). Mean scores indicated that the AN group reported higher scores on the Personal Distress scale than the healthy control group.

Group comparisons should be considered in the context of some of the present sample healthy control sample mean scores being dissimilar from those reported for the previously published healthy control reference group. The AN specific group means on subscales were generally close to those of the healthy control reference group with the exception of the Personal Distress subscale.

AN Group Specific Measures

Mean scores and standard deviations were calculated for AN specific measures to provide information on the levels of eating disorder severity and mental health pathology within the AN sample (see Table 4).

EDEQ-A

All mean scores for scales are out of a possible six, with higher scores indicating increased eating disorder severity. In the present sample, the Total mean was lower than the mean score reported in a large clinical sample of female adolescents (*N*=570; *M*=3.03; *SD*=1.71), but higher than the mean reported for a non-clinical sample in the same study (*N*=487; *M*=1.0; *SD*=2.18; Forsen Mantilla et al., 2017; see Table 4). It should be noted that the clinical sample of this group was made up of adolescents with various eating disorders, 44.7% of which had AN. Comparisons with this study are made throughout the EDEA-Q subscales to aid interpretation.

For subscales, the mean score for the Dietary Restraint scale was lower than the mean reported in the sample involved in the development of the measure (*M*=2.*92*; *SD*=2.00) but higher than the non-clinical sample (*M*=.78; *SD*=2.3). The mean score for the Eating Concern subscale was slightly lower than the clinical sample mean 2.33 (*SD*=1.56) and higher than the non-clinical sample mean of .61 (*SD*=.90). The Shape Concern subscale was the highest for the

present AN sample on the EDEQ-A. This was also lower than the mean reported in the standardisation sample (*M=3.77*; *SD*=1.92) and higher than the non-clinical sample of adolescents used as reference (*M*=1.41; *SD*=1.42). The Weight Concern subscale was lower within the present sample than clinical mean samples (*M*=3.12; *SD*=1.88) and higher than non-clinical adolescents (*M*=1.34; *SD*=1.3).

Overall the AN group mean scores on the EDEQ-A were similar to the mean scores of the clinical sample used as a reference group. Mean scores were also considerably higher than the means of a non-clinical sample. These comparisons collectively indicate the present sample experiencing eating disorder severity consistent with a clinical eating disorder sample.

EDFLIX

Higher scores on this measure are associated with increased flexibility, and lower scores indicate increased rigidity. The EDFLIX Total mean score for the present sample was higher than norms for an adult AN group (*N*=114; *M*=95.4; *SD*=23.4) published as part of the development of the measure (Dahlgren et al., 2019). The present EDFLIX Total mean was lower than the Total score for the non-clinical sample published within the same study (*N*=288; *M*=176.5; *SD*=19.9), indicating increased rigidity relative to a control sample (see Table 4).

The mean score for the General Flexibility scale was marginally higher than the clinical standardisation sample mean of 50.0 (*SD*=13.8), but considerably lower than the standardisation non-clinical sample of 81.1 (*SD*=11.1.8). The present mean for the Food and Exercise Flexibility subscale was higher than the AN sample mean 33.8 (*SD*=10.5) and lower than the non-clinical sample (*M*=64.7; *SD*=8.7). The mean for the Weight and Shape Flexibility subscale was also higher than the AN group in the measure development sample (*M*=11.8; *SD*=2.6) but lower than the non-clinical sample (*M*=30.4; *SD*=4.8).

Although the mean scores in the present sample are not at the same level of eating related rigidity reported in the AN group within the normative sample, potentially as a result of their younger age, it is clear that the present sample experience considerably more eating related rigidity than a non-clinical sample.

Table 4. *AN Group Specific Measures*

	AN		
	n	***M***	***SD***
EDEQ-A Total	25	2.57	1.9
Dietary Restraint		2.3	2.08
Eating Concern		2.11	1.7
Shape Concern		3.12	2.21
Weight Concern		2.74	2.09
EDFLIX Total	24	123.58	25.83
General Flexibility		56.88	11.03
Food and Exercise Flexibility		45.63	20.67
Weight and shape Flexibility		20.67	9.03
RCADS	22		
Total Anxiety and Depression		57.73	12.21
Total Anxiety		56.82	12.21
Separation Anxiety		57.95	14.29
Social Phobia		57.95	9.4
General Anxiety		50.64	10.42
Panic		55.82	13.29
OCD		51.73	11.76
Depression		58.41	12.21

RCADS

Responses on the RCADS were converted to t-scores with a ceiling of 80 and a floor of approximately 40. Scores in the 65-70 range on this measure are considered borderline clinical, and scores above 70 deemed in the clinical range (Chorpita et al., 2000). Mean scores can be observed in Table 4.

For the Total Anxiety and Depression scale, approximately 20% of the sample scored within the borderline or clinical range. For the Total Anxiety scale, this figure was 13.6%. On the Separation Anxiety subscale, 22.7% of the sample scores were within the borderline or clinical range. For the Social Phobia scale, 18.2% of the sample were in the borderline or clinical range. On the General Anxiety subscale, 13.6% of the sample were with the borderline or clinical range. This figure was 13.6% for the Panic subscale and 9.1% for the OCD subscale. For the Major Depressive Disorder subscale, 22.7% of the sample scored within the borderline or clinical range.

Examination of the RCADS scale scores indicates that a considerable percentage of the AN group may experience a variety of mental health difficulties. The foremost of these difficulties within the sample are Anxiety and Depression, Separation Anxiety and Social Phobia.

Correlations

The relationships between variables pertaining the ASD traits, social and emotional cognition and self-reported mental health difficulties through the RCADS in the AN group were investigated through a two-tailed Pearson's correlation coefficient (see Table 5). Significance was measured at the $p<.05$ and $p<.01$ levels. Significant correlations between variables were visualised on scatterplots (see Appendix 20) to aid interpretation.

%WFH and BMI

There were no significant correlations between %WFH and other variables. There was a medium correlation between BMI and the EDEA-Q (r=.429; n=24; p<.05), scatter plots indicated that as BMI increased so did self-reported eating disorder symptom severity.

AQ

There was a large positive correlation between the AQ and Perspective Taking subscale of the IRI (r=.622; n=26; p<.01) where higher ASD traits as measured by the AQ were associated with the increased self-reported perspective-taking. There was a medium negative correlation between the AQ and the EDFLIX Total score (r=-.450; n=24; p<.05). An inspection of the scatter plot indicated that higher AQ scores were associated with reduced flexibility as measured by the EDFLIX Total score.

RMET

There was a medium negative correlation between the RMET and TAS-20 Total score (r=-.423; n=26; p<.05), where higher RMET scores were associated with lower self-reported alexithymia.

TAS-20

There was a medium positive correlation between the TAS-20 Total scale and the EDEQ-A Total scale (r=.424; n= 24; p<.05). Higher alexithymic traits as measured by the TAS-20 were associated with increased severity of eating disorder symptoms.

IRI

There was a medium positive correlation between the Perspective Taking subscale and the Total Anxiety and Depression subscale of the RCADS (r=.434; n=21; p<.05). The Fantasy and Empathetic Concern subscales were not correlated with any scales not on the IRI**.** There

was a medium negative correlation between the Personal Distress subscale of the IRI and the EDFLIX Total scale (r=-.434; n=23; p<.05). This indicates that increased personal distress in response to others discomfort is associated with reduced eating related flexibility. Higher Personal Distress scores were also observed to be positively correlated with the Total Anxiety and Depression (r=.498; n=21; p<.05).

EDEQ-A Total

There was a large negative correlation between the EDEQ-A Total and the EDFLIX Total scores (r=-.742; n=23; p<.01). An inspection of the scatter plot indicated that increased self-reported eating disorder severity was associated with reduced EDFLIX flexibility.

EDFLIX Total

The was a large negative correlation between the EDFLIX and Total Anxiety and Depression subscale (r=-.713; n= 22; p<.01). Inspections of scatter plots indicated that lower flexibility is associated with increased psychopathology as measured by the RCADS.

Table 5. *Correlations Table*

	1	2	3	4	5	6	7	8	9	10
1. %WFH										
2. AQ	-.036									
3. RMET	-.181	-.15								
4. TAS	.34	.198	-.423*							
IRI										
5. Fantasy	.103	.2	.049	-.268						
6. Perspective taking	.188	.622**	-.227	.146	.325					
7. Empathic concern	-.095	.268	.137	-.146	.455*	.446*				
8. Personal distress	.059	.101	.095	.043	.243	.116	.241			
9. EDEQ-A-Total	.4	.194	-.234	.424*	-.214	.232	.02	.378		
10. EDFLIX-Total	.017	-.450*	-.17	-.1	-.047	-.214	-.023	-.434*	-.742**	
11. RCADS - Total Anxiety and Depression	-.212	.412	-.039	.219	.372	.434*	.354	.498*	.384	-.713**

%W4H = Percentage Weight for Height, AQ =Autism Quotient, RMET = Reading the Mind in The Eyes Task, TAS-20= Toronto Alexithymia Scale, IRI= Interpersonal Reactivity Index

** Correlation is significant at the 0.01 level (2-tailed) * Correlation is significant at the 0.05 level (2-tailed).

Discussion

This research aimed to investigate ASD traits and the social and emotional cognitive profiles of young people with AN. This is to understand to what extent commonly reported traits within the literature associated with ASD are present in AN in the early stages of the illness prior to prolonged nutritional deprivation.

AQ

Although the overall hypothesis related to the AQ and most subscales was not substantiated, this finding is caveated by the uncommonly high healthy control group mean scores on this measure. However, it is also possible that on average adolescents with AN may not have more ASD traits than healthy adolescents.

When mean scores were compared to a large sample of neurotypical adults, the mean scores for both groups were considerably higher than those previously reported for AQ Total and the majority of subscales (Baron-Cohen et al. 2001). Further to the previously referenced sample of healthy adults, the present control group mean scores were substantially higher than the mean score of 1038 healthy adolescents (M=15.5) on the AQ (Baron-Cohen et al., 2013).

There is no clear explanation for the higher healthy control group scores. Measures were administered to students attending a mainstream secondary school; participants were asked to report if they had ASD and were screened out accordingly. Despite this high mean score for the healthy control group, it was still within one standard deviation of the neurotypical sample norm (Baron-Cohen et al. 2001) and below the threshold of the BAP (Wheelwright et al., 2010). Additionally, high scores approximate to the present healthy control group have also been reported in non-clinical samples previously (Baron-Cohen et al. 2001). As ASD traits are proposed to be normally occurring within the population, it is possible that the present healthy

control group ASD traits may be explained through expected variation within the normal population.

When interpreting of the present AN group mean score in the context of prior research conducted with adolescents and young people with AN, the present AN group AQ Total mean score of 21.11 is higher than any previously reported in the literature with adolescents (*M*=21; Baron-Cohen et al., 2013; *M*=16.60; Björnsdotter et al., 2019; *M*=21.04; Calderoni et al., 2015; *M*=17.6; Karjalainen et al., 2019; *M*=19.9; Tonaccai et al., 2019). The absence of a group difference on the AQ Total scale in the present study is inconsistent with the aforementioned studies, with the exception of Tonaccai et al., (2019). When considering the difference observed between groups on the Attention Switching subscale in the present study, the only study to publish results for subscale comparisons on the AQ was Calderoni et al. (2015), where the same result was reported. The present findings, taken in conjunction with prior research utilising the AQ suggest that adolescents experience increased ASD traits as measured by the AQ prior to prolonged periods of nutritional deprivation.

Correlational analysis conducted with AN group on the AQ indicated a positive association between the AQ and Perspective Taking subscale of the IRI where higher ASD traits were associated with the increased self-reported perspective taking behaviour. This finding was counter to expectation due to ASD traits generally being associated with increased ToM difficulties. This increased propensity to perspective take may reflect a socially motivated effort or cognitive strategy to mask ASD traits. This relationship between the AQ and Perspective Taking subscale may reflect an adaptive socio-cognitive strategy previously suggested to help camouflage ASD traits, particularly in females with ASD (Hull et al., 2020).

This was the first study to assess the relationship between the AQ and EDFLIX, where higher AQ scores were also associated with increased eating disorder related rigidity. This is

unsurprising given the association between ASD and reduced cognitive flexibility within the literature. This also reflects the main finding on the Attention Switching subscale and provides further evidence that the AN group experience challenges in cognitive and food related flexibility that may contribute AN severity. There was no association between how underweight a participant was and their AQ score.

RMET

The AN group mean score was higher than the healthy control group on the RMET. When assessing statistically for group differences on the RMET the AN group performed significantly better than the healthy control group. Caution is required in the interpretation of this finding due to an unusually low mean score returned by the healthy control group. This score was lower than the mean previously reported for the ASD group used as reference in the results (Baron-Cohen et al., 2001). The control group score was also considerably lower than the mean scores reported for a sample of 246 adolescents (M= 25.7; Laghi et al., 2020) and all but one mean score reported as part of a systematic review of 13 studies utilising the RMET (Vellante et al., 2013). This limits the inferences that can be drawn from between-group comparisons in the present study. Due to the healthy control group being administered this measure in an uncontrolled environment, this may have led to less accurate responding and resulting a considerably lower mean score. As the RMET was administered towards the end of a long series of questionnaires, it is also possible that responses may have been less considered or careless.

When the AN mean score is contrasted to previously published scores for the RMET, they appear to be similar to those for non-clinical samples such as the aforementioned Laghi et al. (2020), Tella et al. (2020; N= 20; M= 26.58) and a large validation sample reported by Vellante et al. (2013; N= 200; M= 24.8). Although not a direct comparison, this suggests that the present AN sample do not experience impairments in ToM. This contrasts prior research using the

RMET (or adapted versions) with adult AN samples where significant differences have been observed (Harrison et al., 2009; Redondoa & Herrero-Fernández, 2018). It does however, add to a growing number of studies indicating that ToM is not impaired when using the RMET with adolescents (Laghi et al., 2015; Nalbant et al., 2019) or other measures of ToM in adult AN groups (Kerr-Gaffney et al., 2020) and irrespective of increased ASD traits (Sedgewick et al., 2019).

Although ToM impairments are associated with ASD, this does not appear to be observed presently despite elevated ASD traits. It has been proposed that people with ASD and particularly females, may "compensate for ToM difficulties by using executive functioning strategies to learn to recognise different facial expressions" (Hull et al., 2020 p.309). This may help explain AN groups scoring similarly to other control groups through the use of pro-social socio-cognitive strategies to mask ASD traits.

There was a significant negative correlation between the RMET and the TAS-20 where increased alexithymia was associated with lower RMET scores. This association is logical as if one cannot identify or describe an emotion experienced by oneself, they will likely have difficulty doing this for another person. This finding is also consistent with the relationship observed between the RMET and alexithymia in a non-clinical sample of adults (Demers & Koven, 2015).

TAS-20

On the TAS-20 the present findings did not observe a significant difference, reference to the interpretive categories and normative and AN specific means within the literature indicate that adults and adolescents with AN experience increased levels of alexithymia. The mean score for the AN group was above the threshold associated for alexithymia and is indicative of the AN group experiencing considerable difficulties in identifying and describing emotions. The

AN group TAS-20 Total scale score was also higher than the mean for the healthy control group which was also high and fell in the borderline alexithymic range. On the Difficulty Identifying Feelings and Difficulty Describing Feelings subscales the AN group also had higher mean scores, with the exception of the Externally Orientated Thinking scale where both groups had a similar mean score. Both groups mean scores were above those previously reported Total scores for neurotypical adults and adults with Asperger's Syndrome/High Functioning Autism (Lombardo et al., 2007). This again limits the inferences that can be drawn from between-group comparisons where no statistically significant differences between the AN and healthy control group were observed.

The pattern of mean scores in the AN group are similar to those reported through a meta-analysis assessing alexithymia in AN where the largest divergence from healthy control means within the prior literature were observed on the Difficulty Identifying Feelings and Difficulty Describing Feelings subscales (Westwood et al., 2017). When compared to research with adolescent AN groups, the present group mean total and subscales were considerably higher than those reported by Nalbant et al. (2019) and Peres et al., (2020). The two aforementioned studies reported significant differences between the AN and control groups for the Difficulty Identifying Feelings and Difficulty Describing Feelings subscales, but not the Externally Orientated Thinking subscale.

The TAS-20 was positively correlated with eating disorder severity as measured by the EDEQ-A where alexithymia was associated with increased eating disorder severity. This may suggest that poor emotional awareness or understanding may result in a maladaptive coping response, potentially leading to increased eating disordered behaviours.

IRI

For the IRI Perspective Taking subscale, statistical between-group comparisons indicated that the difference between the overall AN group and healthy control group was not significant. The AN group mean score was higher than the healthy control group and was similar to that of the healthy control reference sample (Lombardo et al., 2007). The present healthy control group mean score was closer to the Asperger's Syndrome/High Functioning Autism study referenced. This indicates that the AN group have an increased propensity to perspective take with respect to the healthy control group.

In the context of prior studies using the IRI with adolescents, the present AN mean score for Perspective Taking was higher than the AN group reported by Peres et al. (*M*=17.4; 2020), where differences with a healthy control group (*M*= 17.5) were also non-significant. In contrast, Calderoni et al. (2013) did observe a difference where their AN group reported significantly lower scores on the Perspective Taking scale than their healthy control group. However, they did not provide a comparable mean score to benchmark the present results off.

As previously addressed, there was a significant correlation between the Perspective Taking scale and the AQ. Correlational analyses also indicated that the Perspective Taking subscale was also positively associated with the Total Anxiety and Depression scale of the RCADS. This suggests that an increased tendency to see things from another's perspective may be associated with increased Anxiety. Collectively these associations may indicate that higher ASD traits may result in the increased use of cognitive strategies such as taking others perspective to mask ASD, ToM, social and communication difficulties.

The AN and healthy control group mean scores on the Fantasy subscale where no statistically significant differences between groups were observed. Mean scores were similar and comparable to those previously reported by Lombardo et al. (2007). They were also

considerably higher than those reported for their Asperger's Syndrome/High Functioning Autism group. Compared to prior adolescent research on the IRI Fantasy subscale, the present AN sample mean was lower than that reported by Peres et al. (*M*=18.0; 2020). They also reported non-significant findings when compared to a healthy control group (*M*=20.0). Calderoni et al. (2013) did, however, report that their AN group had significantly lower scores on the Fantasy subscale than the healthy control group.

Mean scores on the Empathetic Concern scale were similar in both groups, with no significant difference observed. The scores for both groups were similar to those previously reported for healthy control adults and higher than those with Asperger's Syndrome or High Functioning Autism as previously referenced. The present result is in line with that reported by both Peres et al. (2020) and Calderoni et al. (2013), where no differences on the Empathetic Concern scale were reported between AN and healthy control groups.

For the Personal Distress scale of the IRI, the AN group mean score was statistically significantly higher. It was also elevated when benchmarked from both the healthy control group mean and the healthy control group sample referenced (Lombardo et al., 2007). The overall healthy control group mean was lower than that reported for the Asperger's Syndrome/High Functioning Autism. Although the present healthy control mean score was considerably higher than the healthy control reference group, there was still a significant difference between the overall AN and control group within the present study.

When viewed in relation to prior research, the mean scores for AN group was higher than that reported by Peres et al. (*M*=17.9; 2020). The result of the overall group comparison also matched that of Peres et al. (2020), where their AN group reported significantly higher scores on the Personal Distress scale. However, Calderoni et al. (2013) did not report a significant difference between their AN and healthy control group on the Personal Distress scale.

The correlational relationship between the Personal Distress scale and the EDFLIX indicated that increased distress in response to others discomfort or stressful situations is associated with reduced eating related flexibility. This may suggest that the restriction and rigidity associated with AN may also be maladaptive strategies to try and experience control in response to distress or anxiety. Higher self-reported Personal Distress was also positively associated with the Total Anxiety and Depression RCADS subscale. This suggests that the increased experience of personal distress is associated with increased mental health difficulties.

Overall there were limited differences in the subscales between groups on the IRI. This is with the exception of the Personal Distress scale where a statistically significant difference was observed. The comparison of results with prior adolescent AN research using the IRI subscales was generally mixed. This is excluding the Empathy scale, where in addition to the present study, both Calderoni et al. (2013) and Peres et al. (2020) reported no significant differences between groups. This suggests that empathy, as measured by the IRI, is not impaired in AN. However, a disparity in results across studies on other IRI subscales does not allow for conclusions to be drawn with respect to other factors implicated in the experience of empathy (Perspective Taking, Fantasy and Personal Distress).

When considered in relation to the wider AN evidence base, an absence of significant difference between adolescent AN groups and healthy controls has also been reported on other measures of empathy (Baron-Cohen et al., 2013; Nalbant et al., 2019). The present results are in line with the findings of a meta-analysis of 14 studies assessing empathy in AN which reported no difference in overall empathy scores between people with AN and healthy controls (Kerr-Gaffney et al., 2019).

Findings in the Context of Wider Theoretical Perspectives

Despite limited differences from the present comparison group, reference to the published literature suggests that the present AN group have increased ASD traits as measured by the AQ. Interestingly, the frequency analysis signified a considerably higher percentage of the AN group reporting scores within the BAP range and above the cut off indicative of ASD than in the control group. This is indicative of a considerable proportion of adolescents with AN, but not all reporting higher ASD traits as measured by the AQ. However, it should be considered that these cut off thresholds are based on a relatively short self-report measure where it cannot be assumed that these higher scoring individuals present with sub-clinical ASD. This indicates that these traits are present during the early stages of the illness and prior to prolonged periods of nutritional deprivation.

When considering these findings in the context of theoretical explanations for ASD traits in AN, it has been proposed that these traits may result from or be compounded by the physiological consequences of starvation, or "neurological scar effect" (Seitz et al., 2018; Westwood et al., 2018). Although the present AN and AN-R group's BMI/%WFH was considered low, it was not severely low (APA, 2013). The weight of the present sample was also relatively higher than the BMI or %WFH reported by other adolescent AN studies assessing ASD traits within the literature (Calderoni et al., 2015; Karjalainen et al., 2019; Lang et al., 2015; Leslie et al, 2020; Tonaccai et al., 2019). With respect to the starvation or neurological scar effect hypothesis, the participants in the present study were closer to a healthy weight than those in previous research. Despite this, the present sample still had higher ASD traits than those reported in previous research. Although tentative, this suggests that the observation of ASD traits in AN may not be entirely due to acute nutritional deprivation associated with the illness.

Additionally, as much of the present AN sample had only recently been referred to a specialist service (over 50% of the AN sample participated at the intake or at 6-week review), and the mean time since admission was approximately six months, this suggests that the periods of nutritional deprivation in the AN group was relatively limited. This also provides evidence that ASD traits are present during the early stages of the illness and do not occur solely in response to a cumulative impact of prolonged periods of nutritional deprivation. This considered, prolonged periods of nutritional deprivation may also compound these difficulties and result in increased ASD traits among older groups with AN (Westwood et al., 2016).

The reduced contribution of starvation to ASD traits in AN suggests that these traits may represent an innate neurodevelopmental disposition (Treasure & Schmidt, 2013). With respect to the role ASD traits may have in the development of AN, higher AQ scores are typically associated with increased "systemising" (Baron-Cohen 2002; Greenberg et al., 2018). Baron-Cohen et al. (2013) propose that this may be associated with the development of AN due to the systemised relationship between food and weight. This may be further compounded through the preoccupation, rigidity, difficulties in attention switching and weak central coherence commonly associated with ASD. These ASD traits and their association with a propensity to systemise may act as a risk factor for the development of AN. However, these ASD traits do not appear to be accompanied by reduced empathy as would be expected with respect to the empathising – systemising hypothesis (Baron-Cohen, 2009).

Despite this observation on the AQ and contrary to expectation, higher ASD traits did not translate to difficulties in ToM in the AN group as assessed through the RMET. One possible explanation for this is that although the RMET is proposed to measure ToM, recent research has indicated that it may be more accurately categorised as a measure of emotional recognition. This contention comes from the RMET being more strongly associated with measures of emotional perception, rather than other measures of ToM (Kittel et al., 2021). This may

potentially explain the performance of the AN group on the RMET, particularly when it has been suggested that females may use adaptive strategies such as learning to recognise facial expressions to overcome ToM difficulties (Hull et al., 2020).

It is also possible that this type of strategy was associated with participant scores on the IRI which indicated that levels of empathy were comparable to other studies referenced with the exception of the Personal Distress scale. Perspective Taking and Fantasy are generally considered to represent cognitive empathy which is proposed to be associated with ToM (Blair, 2005). As there was a strong positive correlation between the Perspective Taking subscale and the AQ, this may reflect strategies to camouflage ASD related difficulties through socio-cognitive strategies as proposed by Hull et al. (2020).

For subscales pertaining to what is generally considered affective empathy, the Empathetic Concern scale appeared to be in line with the present and referenced healthy control groups. The Personal Distress subscale was considerably elevated in relation to the healthy control reference group and AN studies examined within the discussion. Increased Personal Distress has previously been associated with higher rates of alexithymia in eating disorder samples (Brewer, et al., 2019; Peres, et al., 2020). It is worth noting that although aspects of the Personal Distress scale relate to the emotional experience of seeing another person in distress, it also appears to assess a person's own experience of being in stressful and emotive situations (i.e. I sometimes feel helpless when I am in the middle of a very emotional situation, Being in a tense emotional situation scares me). This suggests that the Personal Distress scale may assess properties of a person's own personal distress tolerance, in addition to their experience of seeing others in difficult situations.

Brewer et al. (2019) propose that poorer awareness of and lack of clarity surrounding emotional experiences associated with alexithymia can result in increased feelings of personal distress in

response to stressful or challenging situations. Here it is suggested that an inability to identify or articulate feelings may act as a barrier to facilitating downregulating the intensity of emotions. This one potential explanation for the higher levels of personal distress reported in the current sample in conjunction with elevated levels of alexithymia. Additionally, the current sample does not appear to be particularly avoidant, as observed from the Externally Orientated Thinking subscale. Rather than being avoidant, they may have specific difficulties in identifying and describing these feelings.

Interestingly, correlational analyses indicated relationships between the EDFLIX and the Personal Distress scale. This association suggests that people with AN may try and develop predictable and controllable patterns around food and calories to manage distress. Although causation cannot be inferred from these relationships and it is based on a small number of items, this association complements the Baron-Cohen et al. (2013) systemising theory. Here it can be suggested that in addition to higher ASD traits and associated proclivity toward systematised relationships, a person's experience of Personal Distress may act as a further risk factor for the development of AN.

As observed from the control group in the present study, increased ASD traits, or indeed higher levels of alexithymia do not necessarily result in a person developing AN. This suggests that there may be other factors that may interact with this profile that could potentially be associated with the pathogenesis of AN. As demonstrated through the use of the RCADS, a considerable number in the AN group appear to experience coexisting mental health difficulties, many of which appear to be anxiety related. Although it is not possible to say if these mental health difficulties occurred in response to AN or were pre-existing, anxiety has been described as a pathway to the development of AN (Kaye et al. 2004). Similarly to the supposition surrounding Personal Distress, it is conceivable that in response to stress, individuals higher in ASD traits

and poorer emotional introspective awareness may fall into patterns of restriction to create a controllable and systematised relationship from which comfort is derived.

Practical Implications

AN has a reputation of being notoriously difficult to treat. As an increasing body of work has demonstrated that individuals with AN commonly have ASD and higher levels of associated traits, it is important that eating disorder services are suitably skilled at recognising the presentation of ASD and associated traits. This may signify the need for further training for healthcare professionals in eating disorder services in order to support their understanding of how ASD or associated traits may impact intervention and engagement.

When providing interventions to individuals with AN and high ASD traits, services may benefit from enacting strategies and practices that have been reported to be successful in working therapeutically with ASD groups. These may include visual aids, written worksheets, the practice of skills in session and opportunities for repetition to improve generalisation of skills (Reaven & Hepburn, 2003; Rotheram-Fuller & MacMullen, 2011; Moree & Davis, 2010).

The benefits of strategies such as these are highlighted through qualitative research conducted with women with autism and the experience of AN (Babb et al., 2021). The research indicated that the adaption of communication such as written summaries after sessions were experienced as supportive. Challenges associated with receiving treatment for ASD patients included overwhelming environments and specific types of intervention considered unsuitable such as music or group therapy. Some participants in the aforementioned study also reported finding it difficult to engage with specific therapeutic approaches such as Cognitive Behavioural Therapy. However, more skill-based therapies such as Dialectical Behavioural Therapy were deemed more favourable.

With respect to the present findings, specifically, the levels of alexithymia observed, this may help explain challenges with therapeutic approaches directed more towards introspection such as Cognitive Behavioural Therapy. Services should also be aware of emotional introspection difficulties in AN and should take this into consideration when selecting therapeutic approaches. Where difficulties in identifying or describing feelings are present, people with AN may benefit from psychoeducation and support with emotional literacy in conjunction with intervention for AN in order to support the best possible outcome. This may also inadvertently help address coexisting mental health difficulties.

Limitations

There are a number of limitations to the present study. Considered initially is the differing data collection procedures applied to both groups where responses for the AN group were collected through hard copy measures generally completed at home. Due to COVID-19, the researcher was unable to administer questionnaires to the control group in person. Instead, they were administered online through data collection software. These differing administration procedures may have influenced responding particularly in the healthy control group as it is unclear as to what the response conditions were like. It is possible there may have been distractions that may have resulted in careless or rushed responding. This may account for unusual scores across a number of measures and limits the inferences that can be drawn from between-group comparisons in the study.

Other limitations to consider are the small self-selecting AN sample where heterogeneity concerning age, gender, weight, AN subtype and stage of treatment may have influenced responses. The present sample were generally not as underweight and had a shorter illness duration than adolescent AN groups reported within prior literature. This may have implications on the generalisability some of findings. Caution is also advised when considering correlations between scales and subscales within the analysis given that subscales are based on

a small number of items. Additionally, the researchers did not have access to participant information pertaining to comorbid diagnosis or medication which may have informed the research further.

Strengths

There were also a number of strengths to the study. Relative to past research, the present study is one of the more comprehensive analyses of ASD traits and their association to social and emotional cognition in adolescent AN. It was also the first study to examine the EDFLIX in an adolescent AN sample and its relationship to ASD traits. This provides useful information relating to the relationship between eating disorder related rigidity and ASD traits.

Although it could not be investigated statistically, the inclusion of males in the AN sample is an important contribution as typically males are underrepresented in the AN literature. Another strength of the present study was that AN participants had a generally short duration of illness. This provided interesting findings with respect to the presence of ASD traits and social and emotional cognition difficulties prior to prolonged periods of nutritional deprivation. The AN group were recruited from two separate geographically diverse centres which increases the generalisability of findings. Prior ASD and social and emotional cognition related research with younger AN groups has generally utilised instruments solely measuring anxiety or depression.

Regarding the data analytic approach, previous literature pertaining to ASD traits and social and emotional cognition do not appear to correct for multiple tests performed on measures that may have resulted in type I errors. The present study employed a more conservative approach to the data analysis where Bonferonni corrections were applied on measures where multiple tests were being performed. Although this provides for more reliable results, due to the number of tests being performed, this may have resulted in an increased risk of type II error. Given the

concerns surrounding the healthy control groups response style, the more conservative corrected approach was deemed most suitable.

Recommendations for Future Research

The present study has highlighted a number of areas that may benefit from further examination. There is an absence of longitudinal research relating to ASD traits, or aspects of social and emotional cognition predating AN that may act as risk factors in the pathogenesis of the disorder. Further research with adolescents is also required to examine if factors identified as elevated within the present research remain so following recovery. This is with a view to understanding if alexithymia and increased personal distress are impacted by the acute starvation associated with the illness. Research is also encouraged to examine the associations between ASD traits, alexithymia, the experience of distress and patterns of coping. As recent research has indicated that the RMET may not be an accurate indicator of ToM, future research considering the relationship between AN, ASD and related traits should employ ToM measures less susceptible to the use of cognitive strategies potentially used to mask ToM difficulties.

An examination of the adolescent AN literature relating to the AQ revealed an absence of the analyses pertaining to the AQ subscales among this adolescent AN cohort. Future research should seek to address this as it will help facilitate further understanding of specific types of ASD traits evident in adolescent AN. To date, AN research has predominantly utilised the AQ. Future research is directed toward incorporating different instruments measuring different or more subtle aspects of ASD traits to further elucidate the nature of ASD related difficulties in AN. Despite the present contribution, there remains a dearth of research considering the presence of ASD traits in males with AN. Additional research efforts will support the examination of ASD traits in AN and to help understand if increased ASD traits are specific to females in this cohort.

Conclusion

Despite findings generally being non-significant the results of the present study represent a profile of adolescents with AN with increased levels of ASD traits, a number of which had scores consistent with the BAP. This indicates that ASD traits are present in the early stages of the illness prior to prolonged nutritional deprivation. These increased ASD traits do not appear to be accompanied by ToM difficulties or deficits in empathy as hypothesised. However, neurodevelopmental difficulties may be compensated for through socio-cognitive strategies such as increased perspective taking or learning to recognise emotions. The profile of AN participants also indicated high levels of alexithymia and levels of distress in response to seeing others in difficult situations or the personal experience of stressful or emotive situations. There was also a range of coexisting mental health difficulties highlighted through a screening questionnaire.

Although group comparisons were generally not significant, the current observations for the AN group correspond to much of the existing adolescent AN literature in relation to ASD traits and social and emotional cognition. It is unclear as to whether this corresponds to a specific female ASD phenotype. Alternately, this type of profile may represent a constellation of specific ASD traits, in combination with poor introspective ability and the experience of high emotional distress resulting in maladaptive regulatory strategies to manage this. This supposition corresponds and adds to the neurodevelopmental systemising hypothesis through the consideration of the role of personal distress and alexithymia and their potential role in the development and maintenance of AN. Although this is an interesting supposition, additional research is required to explore this further.

References

Aardoom, J. J., Dingemans, A. E., Landt, M. C., & Furth, E. F. (2012). Norms and discriminative validity of the Eating Disorder Examination Questionnaire (EDE-Q). *Eating Behaviours, 3*(4), 305-309.

APA. (2013). *Diagnostic and statistical manual of mental disorders.* Washington DC: American Psychiatric Publishing.

Babb, C., Brede, J., Jones, C. R., Elliott, M., Zanker, C., Tchanturia, K., . . . Fox, J. R. (2021). 'It's not that they don't want to access the support . . . it's the impact of the autism': The experience of eating disorder services from the perspective of autistic women, parents and healthcare professionals. *Autism*. doi:doi.org/10.1177/1362361321991257

Bagby, R. M., Parker, J. D., & Taylor, G. J. (1994). The twenty-item Toronto Alexithymia Scale--I. Item selection and cross-validation of the factor structure. *Journal of Psychosomatic Research, 38*(1), 23-32.

Bagby, R. M., Parker, J. D., & Taylor, G. J. (2020). Twenty-five years with the 20-item Toronto Alexithymia Scale. *Journal of Psychosomatic Research, 131*(109940). doi:10.1016/j.jpsychores.2020.109940.

Bagby, R. M., Taylor, G. J., & Parker, J. D. (1994). The twenty-item Toronto Alexithymia scale—II. Convergent, discriminant, and concurrent validity. *Journal of Psychosomatic Research, 38*(1), 33-40.

Bardone-Cone, A. M., & Boyd, C. A. (2007). Psychometric Properties of Eating Disorder Instruments in Black and White Young Women: Internal Consistency, Temporal Stability, and Validity. *Psychological Assessment, 19*(3), 356 –362.

Baron-Cohen, S. (2002). The extreme male brain theory of autism . *Trends in Cognitive Sciences, 6*(6), 248-254.

Baron-Cohen, S., Jaffa, T., Davies, S., Auyeung, B., Allison, C., & Wheelwright, S. (2013). Do girls with anorexia nervosa have elevated autistic traits? *Molecular Autism, 4*(24). doi:https://doi.org/10.1186/2040-2392-4-24

Baron-Cohen, S., Wheelwright, S., Hill, J., Raste, Y., & Plumb, I. (2001). The "Reading the mind in the eyes" Test revised version: A study with normal adults, and adults with Asperger syndrome or high-functioning autism. *Journal of Child Psychology and Psychiatry, 42*(2), 241-251.

Baron-Cohen, S., Wheelwright, S., Skinner, R., Martin, J., & Clubley, E. (2001). The Autism-Spectrum Quotient (AQ): Evidence from Asperger Syndrome/High-Functioning Autism, Malesand Females, Scientists and Mathematicians. *Journal of Autism and Developmental Disorders, 31*, 5-17.

Berg, K. C., Peterson, C. B., Frazier, P., & Crow, S. J. (2012). Psychometric evaluation of the eating disorder examination and eating disorder examination-questionnaire: a systematic review of the literature. *International Journal of Eating Disorders, 45*(3), 428-438.

Blair, R. (2005). Responding to the emotions of others: Dissociating forms of empathy through the study of typical and psychiatric populations. Consciousness and Cognition, 14(4), 698-718.

Bland, J. M., & Altman, D. G. (1995). Multiple significance tests: the Bonferroni method. BMJ, 310(6973), 170.

Björnsdotter, M., Davidovic, M., Karjalainen, L., Starck, G., Olausson, H., & Wentz, E. (2018). Grey matter correlates of autistic traits in women with anorexia nervosa. *Journal of Psychiatry and Neuroscience, 43*(2), 79–86.

Brewer, R., Cook, R., Cardi, V., Treasure, J., Catmur, C., & Bird, G. (2019). Alexithymia explains increased empathic personal distress in individuals with and without eating disorders. *Quarterly Journal of Experimental Psychology, 72*(7), 1827–1836.

Calderoni, S., Fantozzi, P., Balboni, G., Pagni, V., Franzoni, E., Apicella, F., ... & Muratori, F. (2015). The impact of internalising symptoms on autistic traits in adolescents with restrictive anorexia nervosa. *Neuropsychiatric Disease and Treatment*, *11*, 75.

Calderoni, S., Fantozzi, P., Maestro, S., Brunori, E., Narzisi, A., Balboni, G., & Muratori, F. (2013). Selective cognitive empathy deficit in adolescents with restrictive anorexia nervosa. *Neuropsychiatric Disease and Treatment, 9*, 1583-1589.

Carter, J. C., Stewart, D. A., & Fairburn, C. G. (2001). Eating disorder examination questionnaire: norms for young Eating disorder examination questionnaire: norms for young. *Behaviour Research and Therapy, 39*, 625–632.

Cath, D., Ran, N., Smit, J., Balkom, A. v., & Comijs, H. (2008). Symptom Overlap between Autism Spectrum Disorder, Generalized Social Anxiety Disorder and Obsessive-Compulsive Disorder in Adults: A Preliminary Case-Controlled Study. *Psychopathology, 41*, 101–110.

Child Outcome Research Consortium. (2021, 01 23). *Revised Children's Anxiety and Depression Scale*. Retrieved from Child Outcome Research Consortium: https://www.corc.uk.net/outcome-experience-measures/revised-childrens-anxiety-and-depression-scale-and-subscales/

Chorpita, B. F., Yim, L., Moffitt, C., Umemoto, L. A., & Francis, S. E. (2000). Assessment of symptoms of DSM-IV anxiety and depression in children: A Revised Child Anxiety and Depression Scale. *Behaviour Research and Therapy, 38,, 38*(8), 835-855.

Chrysikou, E. G., & Thompson, W. J. (2016). Assessing cognitive and affective empathy through the interpersonal reactivity index: an argument against a two-factor model. *Assessment*, *23*(6), 769-777.

Craparo, G., Faraci, P., & Gori, A. (2015). Psychometric properties of the 20-item Toronto Alexithymia Scale in a group of Italian younger adolescents. *Psychiatry investigation*, *12*(4), 500.

Cronbach, L. (1951). Coefficient alpha and the internal structure of tests. *Psychomerika, 16,* 297-334. doi:10.1007/BF02310555

Dahlgren, C. L., Hage, T. W., Wonderlich, J. A., & Stedal, K. (2019). General and Eating Disorder Specific Flexibility: Development and Validation of the Eating Disorder Flexibility Index (EDFLIX) Questionnaire. *Frontiers Psychology, 10*(663).

Davis, M. (1980). A multidimensional approach to individual differences in differences in empathy. *JSAS Catalog of Selected Documents in Psychology, 10*.

Dalle-Grave, R., & Calugi, S. (2020). *Cognitive Behavior Therapy for Adolescents with Eating Disorders.* New York: Guilford Press.

Demers, L. A., & Koven, N. S. (2015). The Relation of Alexithymic Traits to Affective Theory of Mind. *The American Journal of Psychology, 128*(1), 31-42.

Donnelly, A., Fitzgerald, A., Shevin, M., & Dooley, B. (2019). Investigating the psychometric properties of the revised child anxiety and depression scale (RCADS) in a non-clinical sample of Irish adolescents. Journal of Mental Health, 28(4), 345-356

Forsen Mantilla, E., Birgegård, A., & Clinton, D. (2017). Factor analysis of the adolescent version of the Eating Disorders Examination Questionnaire (EDE-Q): results from Swedish general population and clinical samples. *Journal of Eating Disorders*, *5*(1), 1-8.

Guan, R.-y., & Qian, M.-y. (2014). Reliabilities and validities of Interpersonal Reactivity Index among nursing students. *Chinese Journal of Clinical Psychology, 22*(3), 493–495.

Greenberg, D. M., Warrier, V., Allison, C., & Baron-Cohen, S. (2018). Testing the Empathizing–Systemizing theory of sex differences and the Extreme Male Brain theory of autism in half a million people. Proceedings of the National Academy of Sciences of the United States of America, 115(48), 12152–12157.

Harrison, A., Sullivan, S., Tchanturia, K., & Treasure, J. (2009). Emotion recognition and regulation in anorexia nervosa. Clinical Psychology & Psychotherapy, 16(4), 348-356.

Hawk, S. T., Keijsers, L., Branje, S. J., Graaff, J. V., Wied, M. d., & Meeus, W. (2013). Examining the Interpersonal Reactivity Index (IRI) among early and late adolescents and their mothers. *Journal of Personality Assessment, 95*(1), 96-106.

Hull, L., Petrides, K., & Mandy, W. (2020). The Female Autism Phenotype and Camouflaging: a Narrative Review. *Review Journal of Autism and Developmental Disorders, 8*, 306–317.

IBM Corp. (2020). IBM SPSS Statistics for Windows. *Version 27.0*. Armonk, NY: IBM Corp.

Karjalainen, L., Råstam, M., Paulson-Karlsson, G., & Wentz, E. (2019). Do autism spectrum disorder and anorexia nervosa have some eating disturbances in common? *European Child & Adolescent Psychiatry*, 69-78. doi:10.1007/s00787-018-1188-y

Kaye, W. H., Bulik, C. M., Thornton, L., Barbarich, N., Masters, K., & Price Foundation Collaborative Group. (2004). Comorbidity of anxiety disorders with anorexia and bulimia nervosa. American Journal of Psychiatry, 161(12), 2215-2221.

Kerr-Gaffney, J., Harrison, A., & Tchanturia, K. (2020). Autism spectrum disorder traits are associated with empathic abilities in adults with anorexia nervosa. *Journal of Affective Disorders, 266*, 273-281.

Kerr-Gaffney, J., Mason, L., Jones, E., Hayward, H., Ahmad, J., Harrison, A., . . . Tchanturia, K. (2020). Emotion Recognition Abilities in Adults with Anorexia Nervosa are Associated with Autistic Traits. *Journal of Clinical Medicine, 9*(1057).

Kittel, A. F., Olderbak, S., & Wilhelm, O. (2021). Sty in the Mind's Eye: A Meta-Analytic Investigation of the Nomological Network and Internal Consistency of the "Reading the Mind in the Eyes" Test. Assessment. doi:doi.org/10.1177/1073191121996469

Kloosterman, P. H., Keefer, K. V., Kelley, E. A., Summerfeldt, L. J., & Parker, J. D. (2011). Evaluation of the factor structure of the Autism-Spectrum Quotient. *Personality and Individual Differences, 50*(2), 310-314.

Kooiman, C. G., Spinhoven, P., & Trijsburg, R. W. (2002). The assessment of alexithymia: a critical review of the literature and a psychometric study of the Toronto Alexithymia Scale-20. *Journal of Psychosomatic Research, 53*(6), 1083-1090.

Laghi, F., Pompili, S., Bianchi, D., Antonia, Lonigro, & Baiocco, R. (2020). Drunkorexia: An Examination of the Role of Theory of Mind and Emotional Awareness among Adolescents. *Developmental Neuropsychology,* 70-81. doi:10.1080/87565641.2020.1869743

Lombardo, M. V., Barnes, J. L., Wheelwright, S. J., & Baron-Cohen, S. (2007). Self-referential cognition and empathy in autism. *PloS one*, *2*(9), e883.

Moree, B. N., & Davis, T. E. (2010). Cognitive-behavioral therapy for anxiety in children diagnosed with autism spectrum disorders: Modification trends. *Research in Autism Spectrum Disorders, 4*(3), 346-354.

Nalbant, K., Kalaycı, B. M., Akdemir, D., Akgül, S., & Kanbur, N. (2019). Emotion regulation, emotion recognition, and empathy in adolescents with anorexia nervosa. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity, 24*, 825–834.

Noetel, M., Miskovic-Wheatley, J., Crosby, R. D., Hay, P., Madden, S., & Touyz, S. (2016). A clinical profile of compulsive exercise in adolescent inpatients with anorexia nervosa. *Journal of Eating Disorders, 4*(1). doi:10.1186/s40337-016-0090-6

Peres, V., Corcos, M., Robin, M., & Pham-Scottez, A. (2020). Emotional intelligence, empathy and alexithymia in anorexia nervosa during adolescence. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity,* 1-8. doi:doi.org/10.1007/s4051

Pedreño, C., Pousa, E., Navarro, J. B., Pàmias, M., & Obiols, J. E. (2017). Exploring the Components of Advanced Theory of Mind in Autism Spectrum Disorder. *Journal of Autism and Developmental Disorders, 47,* 2401–2409.

Piqueras, J. A., Martín-Vivar, M., Sandin, B., San Luis, C., & Pineda, D. (2017). The Revised Child Anxiety and Depression Scale: A systematic review and reliability generalization meta-analysis. Journal of Affective Disorders, 218, 153-169.

Qualtrics. (2020). Qualtrics. Retrieved 2020, from Qualtrics: https://www.qualtrics.com

R Core Team. (2020). R: A language and environment for statistical computing. *R Foundation for Statistical Computing*. Retrieved from https://www.R-project.org/

Reaven, J., & Hepburn, S. (2003). Cognitive-behavioral treatment of obsessive–compulsive disorder in a child with Asperger syndrome: A case report. *Autism, 7*, 145-164.

Redondoa, I., & Herrero-Fernández, D. (2018). Validation of the Reading the Mind in the Eyes Test in a healthy Spanish sample and women with anorexia nervosa. *Cognitive Neuropsychiatry*. doi:10.1080/13546805.2018.1461618

Rotheram-Fuller, E., & MacMullen, L. (2011). Cognitive-behavioral therapy for children with autism spectrum disorders. *Psychology in the Schools, 48*(3), 263-271.

Säkkinen, P., Kaltiala-Heino, R., Ranta, K., Haataja, R., & Joukamaa, M. (2007). Psychometric properties of the 20-item toronto alexithymia scale and prevalence of alexithymia in a finnish adolescent population. *Psychosomatics, 48*(2), 154-161.

Sedgewick, F., Leppanen, J., Goh, F., Hayward, H., Happé, F., & Tchanturia, K. (2019). Similarities and Differences in Theory of Mind Responses of Patients With Anorexia Nervosa With and Without Autistic Features. *Frontiers in Psychiatry, 10*. doi:10.3389/fpsyt.2019.00318

Seitz, J., Konrad, K., & Herpertz-Dahlmann, B. (2018). Extend, Pathomechanism and Clinical Consequences of Brain Volume Changes in Anorexia Nervosa. Current Neuropharmacology, 16(8), 1164–1173. doi:10.2174/1570159X15666171109145651

Stevenson, J. L., & Hart, K. R. (2017). Psychometric Properties of the Autism-Spectrum Quotient for Assessing Low and High Levels of Autistic Traits in College Students. *Journal of Autism and Developmental Disorders, 47*, 1838–1853.

Stewart, M. E., & Austin, E. J. (2009). The structure of the Autism-Spectrum Quotient (AQ): Evidence from a student sample in Scotland. *Personality and Individual Differences, 47*(3), 224-228.

Tella, M. D., Adenzato, M., Catmur, C., Miti, F., Castelli, L., & Ardito, R. B. (2020). The role of alexithymia in social cognition: Evidence from a non-clinical population. *Journal of Affective Disorders, 273*, 482-492.

Torres, S., Guerra, M. P., Miller, K., Costa, P., Cruz, I., Vieira, F. M., . . . Rocha, M. (2019). Factorial Validity of the Toronto Alexithymia Scale (TAS-20) in Clinical Samples: A Critical Examination of the Literature and a Psychometric Study in Anorexia Nervosa. *Journal of Clinical Psychology in Medical Settings, 26*, 33–46.

Tonacci, A., Calderoni, S., Maestro, L. B., Fantozzi, P., FedericaCiuccoli, Morales, M. A., . . . Muratori, F. (2019). Autistic traits impact on olfactory processing in adolescent girls with Anorexia Nervosa restricting type. *Psychiatry Research, 274*, 20-26.

Van Buuren, S., & Groothuis-Oudshoorn, K. (2011). mice: Multivariate Imputation by Chained Equations in R. *Journal of Statistical Software, 45*(3), 1-67. Retrieved from https://www.jstatsoft.org/article/view/v045i03

Vellante, M., Baron-Cohen, S., Melis, M., Marrone, M., Petretto, D. R., Masala, C., & Preti, A. (2013). The “Reading the Mind in the Eyes” test: Systematic review of psychometric properties and a validation study in Italy. *Cognitive Neuropsychiatry, 18*(4), 326–354. doi:10.1080/13546805.2012.721728

Westwood, H., Eisler, I., Mandy, W., Leppanen, J., Treasure, J., & Tchanturia, K. (2016). Using the Autism-Spectrum Quotient to Measure Autistic Traits in Anorexia Nervosa: A Systematic Review and Meta-Analysis. *Journal of Autism and Developmental Disorders, 46*(3), 964-77.

Westwood, H., Kerr-Gaffney, J., Stahl, D., & Tchanturia, K. (2017). Alexithymia in eating disorders: Systematic review and meta-analyses of studies using the Toronto Alexithymia Scale. *Journal of Psychosomatic Research, 99*, 66-81.

Westwood, H., Mandy, W., Simic, M., & Tchanturia, K. (2018). Assessing ASD in Adolescent Females with Anorexia Nervosa using Clinical and Developmental Measures: a Preliminary Investigation. Journal of Abnormal Child Psychology, 46(1), 183–192.

Wheelwright, S., Auyeung, B., Allison, C., & Baron-Cohen, S. (2010). Defining the broader, medium and narrow autism phenotype among parents using the Autism Spectrum Quotient (AQ). *Molecular Autism, 1*(1), 1-9.

Wouters, S., & Spekb, A. (2011). The use of the Autism-spectrum Quotient in differentiating high-functioning adults with autism, adults with schizophrenia and a neurotypical adult control group. *Research in Autism Spectrum Disorders, 5*(3), 1169-1175.

Appendix

Appendix 1: Individual search strategies

Resource name	Details of search	Number of returns
EBSCO Academic Search Complete CINAHL Plus with Full Text MEDLINE APA PsycArticles APA PsycInfo Social Sciences Full Text (H.W. Wilson) ERIC	(AB (anorexia or anorexia nervosa or eating disorder or eating-disorder or anorexic)) AND (AB (autism or asd or autism spectrum disorder or autism-spectrum-disorder or asperger) OR AB (social cognition) OR AB (autism quotient OR AQ or autism spectrum quotient or autism-spectrum quotient)) APA PsycInfo 284 Academic Search Complete 283 MEDLINE 238 CINAHL Plus with Full Text 80 Social Sciences Full Text (H.W. Wilson) 22 ERIC 9 APA PsycArticles 7 General Science Full Text (H.W. Wilson) 5 Link to search results: https://ucc.idm.oclc.org/login?URL=http://search.ebscohost.com.ucc.idm.oclc.org/login.aspx?direct=true&db=a9h&db=rzh&db=eric&db=gft&db=cmedm&db=pdh&db=psyh&db=ssf&bquery=(AB+(+anorexia+or+anorexia+nervosa+or+eating+disorder+or+eating-disorder+or+anorexic+))+AND+(AB+(+autism+or+asd+or+autism+spectrum+disorder+or+autism-spectrum-disorder+or+asperger+)+OR+AB+(social+cognition)+OR+AB+(+autism+quotient+OR+AQ+or+autism+spectrum+quotient+or+autism-spectrum+quotient++))&cli0=RV&clv0=Y&cli1=DT1&clv1=200101-202010&dli0=LA1&dlv0=Y&dld0=rzh&dli1=CT2&dlv1=Y&dld1=rzh&dli2=LA99&dlv2=eng&dld2=rzh&dli3=LA1&dlv3=Y&dld3=cmedm&dli4=CT2&dlv4=Y&dld4=cmedm&dli5=LA1&dlv5=Y&dld5=psyh&type=1&searchMode=Standard&site=ehost-live	928 Returned 573 once exact duplicates removed

PubMed	((anorexia[Title/Abstract] OR anorexia nervosa[Title/Abstract] OR eating disorder[Title/Abstract] OR eating-disorder[Title/Abstract] OR anorexic[Title/Abstract])) AND ((autism[Title/Abstract] OR asd[Title/Abstract] OR autism spectrum disorder[Title/Abstract] OR autism-spectrum-disorder[Title/Abstract] OR asperger[Title/Abstract] OR social cognition[Title/Abstract] OR autism quotient[Title/Abstract] OR autism spectrum quotient[Title/Abstract] OR autism-spectrum quotient[Title/Abstract])) https://pubmed-ncbi-nlm-nih-gov.ucc.idm.oclc.org/?term=((anorexia%5BTitle%2FAbstract%5D%20OR%20anorexia%20nervosa%5BTitle%2FAbstract%5D%20OR%20eating%20disorder%5BTitle%2FAbstract%5D%20OR%20eating-disorder%5BTitle%2FAbstract%5D%20OR%20anorexic%5BTitle%2FAbstract%5D))%20AND%20((autism%5BTitle%2FAbstract%5D%20OR%20asd%5BTitle%2FAbstract%5D%20OR%20autism%20spectrum%20disorder%5BTitle%2FAbstract%5D%20OR%20autism-spectrum-disorder%5BTitle%2FAbstract%5D%20OR%20asperger%5BTitle%2FAbstract%5D%20OR%20social%20cognition%5BTitle%2FAbstract%5D%20OR%20autism%20quotient%5BTitle%2FAbstract%5D%20OR%20autism%20spectrum%20quotient%5BTitle%2FAbstract%5D%20OR%20autism-spectrum%20quotient%5BTitle%2FAbstract%5D))&filter=years.2001-2020&size=200&timeline=expanded	257 Returned
Science Direct	((anorexia or anorexia nervosa or eating disorder or eating-disorder or anorexic)) AND ((autism or asd or autism spectrum disorder or autism-spectrum-disorder or asperger) OR (social cognition) OR (autism quotient OR AQ or autism spectrum quotient or autism-spectrum quotient)) https://www-sciencedirect-com.ucc.idm.oclc.org/search?qs=%28%28anorexia%20or%20anorexia%20nervosa%20or%20eating%20disorder%20or%20eating-disorder%20or%20anorexic%29%29%20AND%20%28%28autism%20or%20asd%20or%20autism%20spectrum%20disorder%20or%20autism-spectrum-disorder%20or%20asperger%20%29%20OR%20%28social%20cognition%29%20OR%20%28autism%20quotient%20OR%20AQ%20or%20autism%20spectrum%20quotient%20or%2	92 Returned

	0autism-spectrum%20quotient%29%29&date=2001-2020&articleTypes=FLA&show=100	
Scopus	(TITLE-ABS-KEY (anorexia OR anorexia AND nervosa OR eating AND disorder OR eating-disorder OR anorexic)) AND (TITLE-ABS-KEY (autism OR asd OR autism AND spectrum AND disorder OR autism-spectrum-disorder OR asperger)) OR (TITLE-ABS-KEY (social AND cognition)) OR (TITLE-ABS-KEY (autism AND quotient OR aq OR autism AND spectrum AND quotient OR autism-spectrum AND quotient)) AND (LIMIT-TO (PUBYEAR , 2020) OR LIMIT-TO (PUBYEAR , 2019) OR LIMIT-TO (PUBYEAR , 2018) OR LIMIT-TO (PUBYEAR , 2017) OR LIMIT-TO (PUBYEAR , 2016) OR LIMIT-TO (PUBYEAR , 2015) OR LIMIT-TO (PUBYEAR , 2014) OR LIMIT-TO (PUBYEAR , 2013) OR LIMIT-TO (PUBYEAR , 2012) OR LIMIT-TO (PUBYEAR , 2011) OR LIMIT-TO (PUBYEAR , 2010) OR LIMIT-TO (PUBYEAR , 2009) OR LIMIT-TO (PUBYEAR , 2008) OR LIMIT-TO (PUBYEAR , 2007) OR LIMIT-TO (PUBYEAR , 2006) OR LIMIT-TO (PUBYEAR , 2005) OR LIMIT-TO (PUBYEAR , 2004) OR LIMIT-TO (PUBYEAR , 2003) OR LIMIT-TO (PUBYEAR , 2002) OR LIMIT-TO (PUBYEAR , 2001)) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (LANGUAGE , "English")) https://www-scopus-com.ucc.idm.oclc.org/results/results.uri?sort=plf-f&src=s&sid=a0b99d91d34f5170b40be09d9914bbef&sot=a&sdt=a&cluster=scosubtype%2c%22ar%22%2ct%2bscopubyr%2c%222020%22%2ct%2c%222019%22%2ct%2c%222018%22%2ct%2c%222017%22%2ct%2c%222016%22%2ct%2c%222015%22%2ct%2c%222014%22%2ct%2c%222013%22%2ct%2c%222012%22%2ct%2c%222011%22%2ct%2c%222010%22%2ct%2c%222009%22%2ct%2c%222008%22%2ct	243 Returned

	%2c%222007%22%2ct%2c%222006%22%2ct%2c%222005%22%2ct%2c%222004%22%2ct%2c%222003%22%2ct%2c%222002%22%2ct%2c%222001%22%2ct%2bscolang%2c%22English%22%2ct&sessionSearchId=a0b99d91d34f5170b40be09d9914bbef&origin=searchadvanced&editSaveSearch=&txGid=1c5c2658d689c5861cabb25d595b4607	
Web of science	((AB=(anorexia OR anorexia nervosa OR eating disorder OR eating-disorder or anorexic)) AND (AB=(autism OR asd OR autism spectrum disorder OR autism-spectrum-disorder OR asperger) OR AB=(social cognition) OR AB=(autism quotient OR AQ or autism spectrum quotient or autism-spectrum quotient))) *AND* **LANGUAGE:** (English) **Refined by: DOCUMENT TYPES:** (ARTICLE) AND **PUBLICATION YEARS:** (2020 OR 2015 OR 2010 OR 2005 OR 2019 OR 2014 OR 2009 OR 2004 OR 2018 OR 2013 OR 2008 OR 2003 OR 2017 OR 2012 OR 2007 OR 2016 OR 2011 OR 2006) https://apps-webofknowledge-com.ucc.idm.oclc.org/summary.do?product=WOS&doc=1&qid=2&SID=E4fzgycVgWzcsP3acTL&search_mode=AdvancedSearch&update_back2search_link_param=yes&excludeEventConfig=ExcludeIfReload	465 Returned
ProQuest	(AB (anorexia or anorexia nervosa or eating disorder or eating-disorder or anorexic)) AND (AB (autism or asd or autism spectrum disorder or autism-spectrum-disorder or asperger) OR AB (social cognition) OR AB (autism quotient OR AQ or autism spectrum quotient or autism-spectrum quotient)) https://search-proquest-com.ucc.idm.oclc.org/central/results/3492CB782F4A4697PQ/1?accountid=14504#	295 Returned

Appendix 2**:** Newcastle Ottawa Quality Assessment Scale for Case Control Studies

Criteria	Baron Cohen et al., (2013)	Björnsdotter et al., 2019	Calderoni et al., 2015	Karjalainen et al., 2019	Lang et al., 2015	Leslie et al., 2020	Tonaccai et al., 2019
Selection							
1) Is the case definition adequate? a) yes, with independent validation + b) yes, e.g. record linkage or based on self-reports c) no description	+	+	+	+	+	+	+
2) Representativeness of the cases a) consecutive or obviously representative series of cases + b) potential for selection biases or not stated	+	+	+	+	+	+	
3) Selection of Controls a) community controls + b) hospital controls c) no description	+		+	+	+	+	+
4) Definition of Controls a) no history of disease (endpoint) + b) no description of source	+	+			+	+	
Comparability							
1) Comparability of cases and controls on the basis of the design or analysis a) study controls for _____ + b) study controls for any additional factor +	+	+ +	+ +	+	+ +	+ +	+ +
Exposure							

1) Ascertainment of exposure a) secure record (eg surgical records) + b) structured interview where blind to case/control status + c) interview not blinded to case/control status d) written self-report or medical record only e) no description	+	+	+	+	+		+
2) Same method of ascertainment for cases and controls a) yes + b) no	+	+	+	+	+	+	+
Stars	7	7	7	7	8	7	6

Note: + Represents stars

Appendix 3: AN group parent/guardian information sheet

Dear parent/guardian

We are inviting your child to participate in research being conducted by the University College Cork School of Applied Psychology and the National Clinical Programme for Eating Disorders. The research is investigating social and emotional thinking styles and traits of young people with eating disorders. The research team include;

- Dr Aileen Whyte, Senior Clinical Psychologist, Child & Adolescent Regional Eating Disorder Service.
- Dr Aoife Dáibhis, Senior Clinical Psychologist, Linn Dara Community Eating Disorders Service. (Linn Dara information sheet only)
- Dr Muireann Treacy, Senior Clinical Psychologist, Linn Dara Community Eating Disorders Service. (Linn Dara information sheet only)
- Dr Sara McDevitt, Consultant Psychiatrist, National Clinical Programme for Eating Disorders.
- Dr Christian Ryan, Senior Lecturer in Clinical Psychology, School of Applied Psychology, University College Cork – christian.ryan@ucc.ie.
- Shane Mulligan - Doctoral Trainee Clinical Psychologist, School of Applied Psychology, University College Cork – 118224907@umail.ucc.ie - 0877159185.

This information leaflet describes the research and what will be involved if you consent for your child to participate.
This study has received ethical approval from University College Cork Clinical Psychology Research Ethics Committees.
Purpose of the study;

- The aim of the research is to investigate aspects of social and emotional functioning among young people with eating disorders, particularly Anorexia Nervosa.
- This will be investigated through questionnaires that ask questions about social and emotional functioning.
- These will be examined in relation to some of the questionnaires your child is requested to complete by the Linn Dara Community Eating Disorder Service (LDCEDS)/Child and Adolescent Regional Eating Disorder Service (CAREDS)
- It is hoped that the findings of the project will help lead to a better understanding of Anorexia Nervosa and assist in its future treatment, it will also form the basis of a clinical psychology doctoral thesis.

Although facilitated by LDCEDS/ CAREDS, your child does not have to participate. Not participating will not change the amount of help they receive from the service.

The study requires that young people;

- Have an eating disorder.
- Are between the age of 12-19.

- Do not have an intellectual disability.
- They and their parent/guardian agree to participation.

What happens if you, and your child accept the invitation to participate?

- You and your child will be asked to complete and sign the accompanying consent (parent/guardian) and assent (young person) forms.
- Once this is done your child can complete the accompanying participant information sheet and self-report questionnaires; this will take around 20-25 minutes).
- Questionnaires consider young people's self-reported patterns of social interaction, communication styles, their ability to identify emotional states in themselves and others. These questionnaires are not diagnostic tools.
- These questionnaires, in addition to 3 of the questionnaires your child has completed for the LDCEDS/CAREDS, will inform the research.
- The service will also provide the research with some general and illness related information (gender, age, body mass, duration of illness).

How will your child's information be protected?

- All participant data will be handled securely and confidentially. Physical copies of all questionnaires completed for the service will remain with LDCEDS/CAREDS.
- LDCEDS/CAREDS staff will provide the researcher with summary information from the questionnaires they requested your child to complete.
- The questionnaires completed specifically for the research will be collected by the researcher and inputted into the research data file on a secure server. Physical copies will be destroyed.
- The researcher will provide the service with a summary of scores on questionnaires which may help inform treatment.
- In accordance with Children's First legislation, if an individual participating in the research discloses that they, or another child is at risk of harm, the research team are mandated to report this. This applies to reports of previous instances of harm also.
- If you decide that you would prefer for your child not to participate, you can withdraw for 2 weeks after the return of the questionnaires.
- All information gathered through the questionnaires will be pooled and analysed anonymously. Your child will not be identifiable. Once the study is completed, anonymised data will be added to the University College Cork research data repository so it may assist in future research.
- It is likely that the findings of the study will be published in an academic journal. If published, the journal may require the researchers to provide access to anonymised data to assure trust in findings.

Is there any risk of harm?

- The risks involved in participation are minimal, and we do not anticipate that your child will experience any negative effects from participation.
- All of the questions are multiple choice and if there are any they do not wish to complete; they can be skipped. Feel free to look at questionnaires prior to deciding on participation.
- If your child does become distressed you are encouraged to seek support for them through your eating disorder team, or resources contained in the accompanying debrief sheet.

What will happen to the results of the study?

- All information will be pooled and analysed anonymously.

- Results will be communicated to the service as a report and also used as part of Shane Mulligan's doctoral thesis.
- Results may also be published in academic journals and presented at academic conferences with a view to furthering knowledge on eating disorders.

If you consent for your child to participate you can;

- Complete the accompanying parental/guardian consent form.
- Speak with them about the study and once they have read the young person information sheet and if happy to participate they can complete the young person assent form.

Completing the questionnaires;

- Once consent forms are signed your child may complete the participant information sheet and questionnaires.
- It is important that these are completed by your child without help. This should ideally be done in a distraction free environment in one sitting.
- Please return these to Linn Dara Community Eating Disorder Service when finished, if completing these at home please use the accompanying envelope.
- Once the questionnaires are completed please refer to accompanying debrief forms.

Should you have any questions or feedback relating to participation please do not hesitate to contact Shane at 087 715 9185 or by email at 118224907@umail.ucc.ie

Thank you very much for your interest in this research study, and we are very grateful for your time and consideration of our invitation

Appendix 4: AN group young person information sheet

University College Cork, Ireland
Coláiste na hOllscoile Corcaigh

Young person information sheet

We are inviting you to take part in research being run by the University College Cork School of Applied Psychology and the National Clinical Programme for Eating Disorders.

This information leaflet describes the research and what will happen if you agree to take part.

Purpose of the study;

- The aim of the research is to look at and better understand the social and emotional thinking styles of young people who have eating disorders.
- Social and emotional thinking styles, and some characteristics like age and gender, will be assessed through self-report questionnaires.
- The research will also use questionnaires to mental health and eating habits used by the Linn Dara Community Eating Disorder Service.
- It is hoped that the findings of the project will lead to a better understanding of eating disorders and assist in its future treatment,
- The project it will also form the basis of an academic project.

Although the research is being assisted by the Linn Dara Community Eating Disorder Service, you do not have to participate. Not taking part will not change the amount of help you receive from them.

Can I participate?
The study requires that young people;

- Have an eating disorder.
- Do not have an intellectual disability.
- Are between the age of 12-19.
- You and your parent/guardian agree to participation.

What happens if you accept the invitation to take part?

- If you agree to take part, you will be asked to complete the accompanying assent form. This means you agree to participate.
- Your parent/guardian will be asked to complete a consent form.
- Once this is done you may complete the information sheet and self-report questionnaires. These should be completed on your own and should take around 20-25 minutes.
- Questionnaires consider young people's self-reported patterns of social interaction, communication styles and their ability to identify emotions in themselves and others.
- These should then be returned to the Linn Dara Community Eating Disorder Service with the other questionnaires they have asked you to fill out.

How will your information be protected?

- All information will be handled confidentially and your input to the research will not be identifiable.

- Once the questionnaires are returned to the service they will be stored safely. The questionnaires the service have requested you to complete will remain with the service.
- Linn Dara Community Eating Disorder Service staff will provide the researcher with summary information from some of the questionnaires they requested you to complete.
- The information will be collected by the researcher and put into the data file on a secure server, physical copies will be destroyed.
- The researcher will provide the service with a summary of scores from the research questionnaires, which may help inform their work with you.
- If you decide that you would prefer not to participate after returning the questionnaires, you can withdraw for 2 weeks following their return.
- In accordance with Children's First legislation, if you inform us that you, or another child is at risk of harm, the research team will have to report this. This applies to reports of harm which happened in the past also.
- Once the study is completed, anonymised information (nobody would know the information is about you) may be added to the University College Cork research bank so it may help in future research.
- It is likely that the results of the study will be published in an academic journal. Journals may require researchers to provide anonymised information to ensure findings are correct.

Is there any risk of harm?
- The risks involved in participation are very small. We do not expect that participating will lead to any negative effects.
- All of the questions are multiple choice and if there are any you do not wish to complete they can be skipped.
- Feel free to look at these questionnaires prior to deciding to participate.
- If you do become distressed you should seek support through your team, and/or resources contained in the accompanying debrief sheet.

What will happen to the results of the study?
- Information collected through questionnaires will be analysed anonymously and will not consider participant responses individually.
- Findings will be communicated to the service and also used as part of Shane Mulligan's doctoral thesis.
- Results may be published in academic journals and reported at conferences. This is for the purpose of helping people to understand eating disorders more and providing information to lead to more effective treatments.

If you wish to participate you can;
- If you have read and understood the information sheet and wish to take part in this research you can complete the assent form in this pack.
- Your parent/guardian is required to complete the consent form.

Completing the questionnaires;
- Once consent and accent forms are signed you may complete the participant information sheet and questionnaires.
- It is important that these are completed without help, there are no right or wrong answers and you can skip questions if you wish.
- Questionnaires should ideally be done in a distraction free environment in one sitting.

- Please return these to Linn Dara Community Eating Disorder Service when finished. If completing these at home, please use the accompanying envelope.
- Once the questionnaires are completed please read the accompanying debrief forms.

Should you have any questions your parent/guardian can contact a member of the research team through phone or email included on the parent/guardian information form.

Thank you very much for your interest in this research study, and we are very grateful for you time and consideration of our invitation

Appendix 5: AN group parent/guardian information sheet for data collection outside of intake/review/discharge

Dear parent/guardian

We are inviting your child to participate in research being conducted by the University College Cork School of Applied Psychology and the National Clinical Programme for Eating Disorders. The research is investigating social and emotional thinking styles and traits of young people with eating disorders. The research team include;

- Dr Aileen Whyte, Senior Clinical Psychologist, Child & Adolescent Regional Eating Disorder Service.
- Dr Aoife Dáibhis, Senior Clinical Psychologist, Linn Dara Community Eating Disorders Service. (Linn Dara information sheet only)
- Dr Muireann Treacy, Senior Clinical Psychologist, Linn Dara Community Eating Disorders Service. (Linn Dara information sheet only)
- Dr Sara McDevitt, Consultant Psychiatrist, National Clinical Programme for Eating Disorders.
- Dr Christian Ryan, Senior Lecturer in Clinical Psychology, School of Applied Psychology, University College Cork – christian.ryan@ucc.ie.
- Shane Mulligan - Doctoral Trainee Clinical Psychologist, School of Applied Psychology, University College Cork – 118224907@umail.ucc.ie - 0877159185.

This information leaflet describes the research and what will be involved if you consent for your child to participate.

This study has received ethical approval from University College Cork Clinical Psychology Research Ethics Committees.
Purpose of the study;

- The aim of the research is to investigate aspects of social and emotional functioning among young people with eating disorders, particularly Anorexia Nervosa.
- This will be investigated through questionnaires that ask questions about social and emotional functioning.
- These will be examined in relation to some of the questionnaires relating to mental health and eating habits used by the Linn Dara Community Eating Disorder Service (LDCEDS)/ Child & Adolescent Regional Eating Disorder Service (CAREDS)
- It is hoped that the findings of the project will help lead to a better understanding of Anorexia Nervosa and assist in its future treatment, it will also form the basis of a clinical psychology doctoral thesis.

Although facilitated by LDCEDS/ CAREDS, your child does not have to participate. Not participating will not change the amount of help they receive from the service.
The study requires that young people;

- Have an eating disorder.
- Are between the age of 12-19.

- Do not have an intellectual disability.
- They and their parent/guardian agree to participation.

What happens if you, and your child accept the invitation to participate?

- You and your child will be asked to complete and sign the accompanying consent (parent/guardian) and assent (young person) forms.
- Once this is done your child can complete the accompanying information sheet and self-report questionnaires, this will take around 30-35 minutes.
- Questionnaires consider young people's self-reported patterns of social interaction, communication styles and their ability to identify emotional states in themselves and others.
- Young people will also be asked to complete questionnaires relating to their mental health, their eating patterns and body image. Questionnaires are not diagnostic tools.
- The service will also provide the research with some general and illness related information (gender, age, body mass, duration of illness).

How will your child's information be protected?

- All participant data will be handled securely and confidentially.
- Once returned to the service questionnaires will be collected by the researcher and input into a data file on a secure server, physical copies will be destroyed.
- The researcher will provide the service with a summary of scores on questionnaires which may help inform treatment.
- In accordance with Children's First legislation, if an individual participating in the research discloses that they, or another child is at risk of harm, the research team are mandated to report this. This applies to reports of previous instances of harm also.
- If you decide that you would prefer for your child not to participate, you can withdraw for 2 weeks after the return of the questionnaires.
- All information gathered through the questionnaires will be pooled and analysed anonymously. Once the study is completed, anonymised data will be added to the University College Cork research data repository so it may assist in future research.
- It is likely that the findings of the study will be published in an academic journal. If published, the journal may require the researchers to provide access to anonymised data to assure trust in findings.

Is there any risk of harm?

- The risks involved in participation are minimal, and we do not anticipate that your child will experience any negative effects from participation.
- All of the questions are multiple choice and if there are any they do not wish to complete; they can be skipped.
- Feel free to look at these questionnaires prior to deciding to consent or not.
- If your child does become distressed you are encouraged to seek support for them through your eating disorder team, and/or resources contained in the accompanying debrief sheet.

What will happen to the results of the study?

- All information will be pooled and analysed anonymously.
- Results will be communicated to the service as a report and also used as part of Shane Mulligan's doctoral thesis.
- Results may also be published in academic journals and presented at academic conferences with a view to furthering knowledge on eating disorders.

If you consent for your child to participate you can;

- Complete the accompanying parental/guardian consent form.
- Speak with them about the study and once they have read the young person information sheet and if happy to participate they can complete the young person assent form.

Completing the questionnaires;

- Once consent forms are signed your child may complete the participant information sheet and questionnaires.
- It is important that these are completed by your child without help. This should ideally be done in a distraction free environment in one sitting.
- Please return these to Linn Dara Community Eating Disorder Service through the accompanying envelope.
- Once the questionnaires are completed please refer to accompanying debrief forms.

Should you have any questions or feedback relating to participation please do not hesitate to contact Shane at 087 715 9185 or by email at 118224907@umail.ucc.ie

Thank you very much for your interest in this research study, and we are very grateful for you time and consideration of our invitation

Appendix 6: AN group young person information sheet for data collection outside of intake/review/discharge

Young person information sheet

We are inviting you to take part in research being run by the University College Cork School of Applied Psychology and the National Clinical Programme for Eating Disorders.

The research is investigating social and emotional thinking styles and traits of young people with eating disorders. This information leaflet describes the research and what will be involved if you agree to participate.

Purpose of the study;

- The aim of the research is to investigate social and emotional thinking styles and characteristics of young people with eating disorders.
- Social and emotional thinking styles and characteristics will be assessed through self-report questionnaires.
- The research will also use questionnaires to mental health and eating habits used by the Linn Dara Community Eating Disorder Service.
- It is hoped that the findings of the project will lead to a better understanding of eating disorders and assist in its the future treatment,
- The project it will also form the basis of an academic project.

Although the research is being assisted by the Linn Dara Community Eating Disorder Service, you do not have to participate. Not taking part will not change the amount of help you receive from them.

Can I participate?
The study requires that young people;

- Have an eating disorder.
- Do not have an intellectual disability.
- Are between the age of 12-19.
- You and your parent/guardian agree to participation.

What happens if you accept the invitation to take part?

- If you agree to take part, you will be asked to complete the accompanying assent form. This means you agree to participate.
- Your parent/guardian will be asked to complete a consent form.
- Once this is done you may complete the information sheet and self-report questionnaires, these should be completed on your own and should take around 30-35 minutes.
- Questionnaires consider young people's self-reported patterns of social interaction, communication styles and their ability to identify emotions in themselves and others.
- You will also be asked to complete questionnaires relating to your mental health, their eating patterns and body image. These are the same questionnaires your team previously asked you to complete.

How will your information be protected?

- All information will be handled confidentially and your input to the research will not be identifiable.
- Once returned to the service questionnaires will be collected by the researcher and input into a data file on a secure server, physical copies will be destroyed.
- The researcher will provide the service with a summary of scores on questionnaires which may help inform your work with them.
- If you decide that you would prefer not to participate after returning the questionnaires, you can withdraw for 2 weeks following their return.
- In accordance with Children's First legislation, if you inform us that you, or another child is at risk of harm, the research team are will have to report this. This applies to reports of harm which has occurred in the past also.
- Once the study is completed, anonymised information may be added to the University College Cork research bank so it may help in future research.
- It is likely that the results of the study will be published in an academic journal. Journals may require researchers to provide anonymised information to ensure findings are correct.

Is there any risk of harm?

- The risks involved in participation are minimal, we do not expect that participating will lead to any negative effects.
- All of the questions are multiple choice and if there are any you do not wish to complete; they can be skipped.
- Feel free to look at these questionnaires prior to deciding to participate.
- If you do become distressed you are encouraged to seek support through your team, and/or resources contained in the accompanying debrief sheet.

What will happen to the results of the study?

- Information collected through questionnaires will be analysed anonymously and will not consider participant responses individually.
- Findings will be communicated to the service and also used as part of Shane Mulligan's doctoral thesis.
- Results may be published in academic journals and reported at conferences. This is for the purpose of helping people to understand eating disorders more and providing information to lead to more effective treatments.

If you wish to participate:

- If you have read and understood the information sheet and wish to participate in this research you can complete the accompanying assent form,
- Your parent/guardian are required to complete the consent form.

Completing the questionnaires;

- Once consent and accent forms are signed you may complete the participant information sheet and questionnaires.
- It is important that these are completed without help, there are no right or wrong answers and you can skip questions if you wish.
- Questionnaires should ideally be done in a distraction free environment in one sitting.
- Please return these to Linn Dara Community Eating Disorder Service when finished, if completing these at home please use the accompanying envelope.

- Once the questionnaires are completed please refer to accompanying debrief forms.

Should you have any questions your parent/guardian can contact a member of the research team through phone or email included on the parent/guardian information form.

Thank you very much for your interest in this research study, and we are very grateful for you time and consideration of our invitation

Appendix 7: AN group parent/guardian consent form

Parent/guardian consent Form

Parent name: _____ (Block capitals) Child name:_____ (Block capitals)	Please tick the box to indicate your consent
I confirm that I have read and understood the information sheet and have received an explanation of the nature, purpose, what my child's participation will involve and how findings will be reported.	
I understand that my child's participation in the study is voluntary and will not impact the input we receive from the Child and Adolescent Regional Eating Disorder Service / Linn Dara Community Eating Disorder Service.	
I understand that anonymised information may be added to the University College Cork research repository and/or be provided as supplementary material if the research is published.	
I consent to the Child and Adolescent Regional Eating Disorder Service providing / Linn Dara Community Eating Disorder Service. information pertaining to my child's weight, height, when they started attending the service, and scores on service questionnaires to be used in the research.	
I understand also that I am free withdraw my child's information for two weeks following the return of the questionnaires.	
I am aware of avenues contained in the debrief sheet through which I, and my child can receive support if partaking in the study results in any upset.	
I agree for my child to take part in the previously described study.	

Signature: _____ Date: _____

Thank you very much for supporting this research study

Please ensure that your child is distraction free and has adequate time to dedicate to the questionnaires prior to beginning

Appendix 8: AN group young person assent form

University College Cork, Ireland
Coláiste na hOllscoile Corcaigh

Young person assent form

Name:_____ (Block capitals)	Please tick the box to indicate your consent
I have read and understood the information sheet and understand the study details, its purpose, what my taking part will involve and how findings will be reported.	
I understand that my participation in the study is voluntary and will not impact the help I receive from the Child and Adolescent Regional Eating Disorder Service/ Linn Dara Community Eating Disorder Service.	
I understand that anonymised information will be added to the University College Cork research databank and/or if published journals may require access to the anonymised information to ensure the study results are correct.	
I agree to the Child and Adolescent Regional Eating Disorder Service/ Linn Dara Community Eating Disorder Service. providing demographic information, when I started attending the service and scores on service questionnaires to be used in the research.	
I understand also that I am free withdraw my information in the two weeks following the return of the questionnaires.	
I am aware that I can receive support from my Child and Adolescent Regional Eating Disorder Service/ Linn Dara Community Eating Disorder Service. and through resources contained in the debrief sheet if partaking in the study results in any upset.	
I agree for to take part in the previously described study	

Signature: _____ Date: _____

Thank you very much for supporting this research study

Please ensure that you are distraction free and have adequate time to dedicate to the questionnaires prior to beginning

Appendix 9: AN group parent/guardian consent form for data collection outside of intake/review/discharge

Parent/guardian consent Form

Parent name: _____ (Block capitals) Child name:_____ (Block capitals)	Please tick the box to indicate your consent
I confirm that I have read and understood the information sheet and have received an explanation of the nature, purpose, what my child's participation will involve and how findings will be reported.	
I understand that my child's participation in the study is voluntary and will not impact the input we receive from the Child and Adolescent Regional Eating Disorder Service/ Linn Dara Community Eating Disorder Service.	
I understand that anonymised information may be added to the University College Cork research repository indefinitely and/or be provided as supplementary material if the research is published.	
I consent to the Child and Adolescent Regional Eating Disorder Service/ Linn Dara Community Eating Disorder Service providing information pertaining to my child's weight, height, when they started attending the service to be used in the research.	
I understand also that I am free withdraw my child's information for two weeks following the return of the questionnaires.	
I am aware of avenues contained in the debrief sheet through which I, and my child can receive support if partaking in the study results in any upset.	
I agree for my child to take part in the previously described study.	

Signature: _____ Date: _____

Thank you very much for supporting this research study

Please ensure that your child is distraction free and has adequate time to dedicate to the questionnaires prior to beginning

Appendix 10: AN group young person assent form for data collection outside of intake/review/discharge

Young person assent form

Name:_____ (Block capitals)	Please tick the box to indicate your consent
I have read and understood the information sheet and understand the study details, its purpose, what my taking part will involve and how findings will be reported.	
I understand that my participation in the study is voluntary and will not impact the help I receive from the Child and Adolescent Regional Eating Disorder Service/ Linn Dara Community Eating Disorder Service.	
I understand that anonymised information will be added to the University College Cork research databank and/or if published journals may require access to the anonymised information to ensure the study results are correct.	
I agree to the Child and Adolescent Regional Eating Disorder Service/ Linn Dara Community Eating Disorder Service. providing demographic information, when I started attending the service and scores on service questionnaires to be used in the research.	
I understand also that I am free withdraw my information in the two weeks following the return of the questionnaires.	
I am aware that I can receive support from my Child and Adolescent Regional Eating Disorder Service/ Linn Dara Community Eating Disorder Service. and through resources contained in the debrief sheet if partaking in the study results in any upset.	
I agree for to take part in the previously described study	

Signature: _____ Date: _____

Thank you very much for supporting this research study

Please ensure that you are distraction free and have adequate time to dedicate to the questionnaires prior to beginning

Appendix 11: Control group parent/guardian information sheet

University College Cork, Ireland
Coláiste na hOllscoile Corcaigh

Parent/guardian information Sheet

This form requires you to reply to this email with your consent if you are agreeable to your child's participation.

Dear parent/guardian

We are inviting your child/adolescent to participate in a study being conducted by the University College Cork School of Applied Psychology and facilitated by the HSE National Clinical Programme for Eating Disorders.

The research is being completed by a team of researchers from University College Cork and the National Clinical Programme for Eating Disorders and the Child and Adolescent Regional Eating Disorder Service, the core research team include;

- Dr Sara McDevitt, Consultant Psychiatrist Cork Kerry Child and Adolescent Regional Eating Disorder Service.and Clinical Lead of the National Clinical Programme for Eating Disorders.
- Dr Christian Ryan, Senior Lecturer in Clinical Psychology, School of Applied Psychology, University College Cork – christian.ryan@ucc.ie.
- Shane Mulligan - Doctoral Trainee Clinical Psychologist, School of Applied Psychology, University College Cork – 118224907@umail.ucc.ie - 0877159185.

This study has received ethical approval from University College Cork Clinical Psychology Research Ethics Committee.
Purpose of the research;

- The aim of the research is to investigate social and emotional functioning among young people with serious eating disorders.
- In order to understand how young people with eating disorders may differ in functioning from young people without the illness, we need to compare them to young people who do not experience this difficulty.
- As part of this we are inviting your child/adolescent to participate as part of our healthy comparison sample. We will not be assessing your child for an eating disorder or mental health difficulties.

It is hoped that findings of the project will lead to a better understanding of eating disorders and assist in their treatment, findings will also form the basis of a clinical psychology doctoral thesis.

What will participation involve?

- Participation in the study is voluntary. If you agree to your child's participation you will be asked to indicate your consent through replying to this email providing your consent for your child to participate

- Your son/daughter will be provided with information on the study and asked to agree to their participation through an online form also.
- As part of the research your son/daughter will be asked to complete a number of questionnaires relating to;
    - Demographic information (gender, age, weight, height, etc.)
    - Patterns of social interaction
    - Communication styles
    - Their ability to identify emotions in themselves and others.
- Questionnaires will be administered through online forms within student's computer classes and should take approximately 25 minutes.

The study requires that young people;

- Are not attending Child and Adolescent Mental Health Services, or Primary Care for any mental health related difficulty.
- Do not have an eating disorder.
- Do not have an intellectual disability.
- Are between the age of 12-19.
- They, and their parent/guardian agree to participation.

Is there any risk of harm?

- The risks involved in participation are minimal, we do not expect that participating will lead to any negative effects. The questionnaires are multiple response, and if there are any they do not wish to complete; they can be skipped.
- Parents/guardians can see the questionnaires prior to deciding on whether to consent if they so wish (contact details for Shane Mulligan are available above).
- In the unlikely event a participant becomes upset students are encouraged to speak with Ms Hay, who in line with school protocols may inform parents/guardians also.
- Although the questionnaires being administered do not relate to mental health, all participants will also be provided with information on general supports in the community that can be accessed should they be experiencing mental health difficulties as part of a debrief note following participation.

How will information be protected?

- Data collected will be anonymous and all data will be handled securely and treated confidentially.
- Information will be gathered through a secure online survey tool, once submitted this information will be stored on a University College Cork secure server until it is downloaded, following this it will be stored on a password protected and encrypted computer for analysis.
- As data will be anonymised we will not be able to identify data to remove it following participation.
- Although this is not foreseen, in accordance with Children's First legislation, if an individual participating in the research discloses that they, or another child is at risk of harm, the research team are obliged to report this. This applies to reports of previous instances of harm also.
- Following the completion of the project, in line with best practice research procedures, anonymised data may be added to the University College Cork research data repository so it may assist in future research.

- It is possible that the findings of the will be published in an academic journal. In the interest of transparency and to assure trust in findings the publishing journal may require the researchers to provide access to anonymised data to assure trust in findings.

What will happen to the results of the study?

- All of the data will be considered anonymously, results of the study will not consider participant responses individually.
- Findings will be communicated to the National Clinical Programme for Eating Disorders as a report and also used as part of Shane Mulligan's doctoral thesis.
- Results may also be published in academic journals and presented at academic conferences.

If you consent for your child to participate;

- Please reply to this email advising that you agree for my child to take part in the previously described study.

- Please reply to this email prior to XX/XX/XX to facilitate participation on the day.

Should you have any questions or feedback relating to participation please do not hesitate to contact Shane at 087 715 9185 or by email at 118224907@umail.ucc.ie

Thank you very much for your interest in this research study, and we are very grateful for you time and consideration of our invitation

Appendix 12: Control group young person information sheet

University College Cork, Ireland
Coláiste na hOllscoile Corcaigh

Young person information Sheet

We are inviting you to participate in research being carried out by the University College Cork School of Applied Psychology and facilitated by the HSE National Clinical Programme for Eating Disorders.

Purpose of the research;

- The aim of the research is to study the social and emotional thinking styles and characteristics of young people who are suffering from serious eating disorders.
- To understand how young people with eating disorders may function differently to young people who don't have an eating disorder we want to compare functioning in certain areas to young people without an eating disorder.
- This is why we are inviting you to take part in our study.
- It is hoped that the findings of the project will help lead to a better understanding of eating disorders and assist in their treatment.
- The research will also form part of a clinical psychology doctoral thesis.

What will participation involve?

- Taking part is voluntary.
- If you agree to take part you will be asked to indicate your consent to participate and complete self-report questionnaires relating to;
    - Demographic information (gender, age, weight, height etc.)
    - Patterns of social interaction
    - Communication styles
    - Your ability to identify emotions in yourself and others.
- Questionnaires will be administered through online forms and should take approximately 25 minutes.

The study requires that young people;

- Are not attending Child and Adolescent Mental Health Services, or Primary Care for any mental health related difficulty.
- Do not have an eating disorder.
- Do not have an intellectual disability.
- Are between the age of 12-19.
- You, and your parent/guardian agree to participation.

Is there any risk of harm?

- The wellbeing of all participants is very import to the study. The risks involved in participation are minimal, we do not expect that participating will lead to any negative effects.
- Questions are multiple response, and if there are any you do not wish to answer; they can be skipped.

- In the unlikely event the contents of the questionnaires lead to you becoming upset you are encouraged to speak with Ms Hay, who in line with school policies may inform your parents/ guardians.
- Although the questionnaires being administered do not relate to mental health, all participants will also be provided with information on general supports in the community that can be accessed should they be experiencing mental health difficulties as part of a debrief note following participation.

How will my information be protected?

- Data collected will be anonymous, additionally all participant data will be kept safe and private.
- Information will be gathered through a secure online survey tool, once submitted this information will be stored on a University College Cork secure server until it is downloaded, following this it will be stored on a password protected and encrypted computer for analysis.
- As data will be anonymised we will not be able to identify data. This mean that following your participation we will not be able to identify your data to remove it.
- In accordance with Children's First legislation, if you inform us that you, or another child is at risk of harm, the research team are will have to report this. This applies to reports of harm which has occurred in the past also.
- Once the study is completed, in line with best practice, anonymised information may be added to the University College Cork research information bank so it may help in future research.
- The research may be published in an academic journal. Sometimes journals require researchers to provide access to the anonymised information that their research is based on to ensure that it is correct.

What will happen to the results of the study?

- All of the data will be considered anonymously, results of the study will not look at or report participant responses individually.
- Findings will be used as part of Shane Mulligan's doctoral thesis.
- Results may also be published in academic journals and reported at academic conferences for the purpose of helping people to understand eating disorders further.

If you wish to participate:

- If you have any questions your parent/guardian can contact Shane on the number included on the parent/guardian consent form.

If you have read and understood the information sheet and wish to participate in this research, please click below where you can complete the accompanying assent form.

FORWARD LINK TO ASSENT FORM

Appendix 12: Healthy control group young person assent form

University College Cork, Ireland
Coláiste na hOllscoile Corcaigh

Child/adolescent assent form

Name:_____ (Block capitals)	Please tick the box to indicate your consent
I confirm that I have read and understood the information sheet and understand the nature of the study, its purpose, what my taking part will involve and how findings will be reported.	
I understand that my participation in the study is voluntary.	
I understand that anonymised information may be added to the University College Cork research information bank indefinitely so it may help in future research.	
I am aware of that I will be given a debrief form after participating on which there are resources for support I can use if partaking in the study results in any upset for me.	
I agree for to take part in the previously described study.	

Thank you very much for supporting this research

LINK TO QUESTIONNAIRES

Appendix 13: Autism-Spectrum Quotient

How to fill out the questionnaire - Below are a list of statements. Please read each statement very carefully and rate how strongly you agree or disagree with it by circling your answer. Please ask a parent if you don't understand a word.

1.	I prefer to do things with others rather than on my own.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
2.	I prefer to do things the same way over and over again.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
3.	If I try to imagine something, I find it very easy to create a picture in my mind.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
4.	I frequently get so strongly absorbed in one thing that I lose sight of other things.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
5.	I often notice small sounds when others do not.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
6.	I usually notice car number plates or similar strings of information.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
7.	Other people frequently tell me that what I've said is impolite, even though I think it is polite.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
8.	When I'm reading a story, I can easily imagine what the characters might look like.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
9.	I am fascinated by dates.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
10.	In a social group, I can easily keep track of several different people's conversations.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
11.	I find social situations easy.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
12.	I tend to notice details that others do not.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
13.	I would rather go to a library than a party.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
14.	I find making up stories easy.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
15.	I find myself drawn more strongly to people than to things.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
16.	I tend to have very strong interests which I get upset about if I can't pursue.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
17.	I enjoy social chit-chat.	Definitely	Slightly	Slightly	Definitely

	Agree	Agree	Disagree	Disagree
18. When I talk, it isn't always easy for others to get a word in edgeways.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
19. I am fascinated by numbers.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
20. When I'm reading a story, I find it difficult to work out the characters' intentions.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
21. I don't particularly enjoy reading fiction.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
22. I find it hard to make new friends.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
23. I notice patterns in things all the time.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
24. I would rather go to the theatre than a museum.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
25. It does not upset me if my daily routine is disturbed.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
26. I frequently find that I don't know how to keep a conversation going.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
27. I find it easy to "read between the lines" when someone is talking to me.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
28. I usually concentrate more on the whole picture, rather than the small details.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
29. I am not very good at remembering phone numbers.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
30. I don't usually notice small changes in a situation, or a person's appearance.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
31. I know how to tell if someone listening to me is getting bored.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
32. I find it easy to do more than one thing at once.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
33. When I talk on the phone, I'm not sure when it's my turn to speak.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
34. I enjoy doing things spontaneously.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
35. I am often the last to understand the point of a joke.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree

36.	I find it easy to work out what someone is thinking or feeling just by looking at their face.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
37.	If there is an interruption, I can switch back to what I was doing very quickly.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
38.	I am good at social chit-chat.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
39.	People often tell me that I keep going on and on about the same thing.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
40.	When I was young, I used to enjoy playing games involving pretending with other children.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
41.	I like to collect information about categories of things (e.g. types of car, types of bird, types of train, types of plant, etc.).	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
42.	I find it difficult to imagine what it would be like to be someone else.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
43.	I like to plan any activities I participate in carefully.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
44.	I enjoy social occasions.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
45.	I find it difficult to work out people's intentions.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
46.	New situations make me anxious.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
47.	I enjoy meeting new people.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
48.	I am a good diplomat.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
49.	I am not very good at remembering people's date of birth.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree
50.	I find it very easy to play games with children that involve pretending.	Definitely Agree	Slightly Agree	Slightly Disagree	Definitely Disagree

Appendix 14: The Reading of the Mind in the Eyes Test

For each set of eyes, choose and circle which word best describes what the person in the picture is thinking or feeling. You may feel that more than one word is applicable but please choose just one word, the word which you consider to be most suitable. Before making your choice, make sure that you have read all 4 words. You should try to do the task as quickly as possible but you will not be timed. If you really don't know what a word means you can look it up in the definition handout.

Example;

The full test can be accessed here;

http://docs.autismresearchcentre.com/tests/adult_part1.pdf

http://docs.autismresearchcentre.com/tests/adult_part2.pdf

Appendix 15: Toronto Alexithymia Scale-20

Using the scale provided as a guide, indicate how much you agree or disagree with each of the following statements by circling the corresponding number. Give only one answer for each statement.

Item	Strongly Disagree	Moderately Disagree	Neither Disagree or Agree	Moderately Agree	Strongly Agree
1. I am often confused about what emotion I am feeling.	1	2	3	4	5
2. It is difficult for me to find the right words for my feelings.	1	2	3	4	5
3. I have physical sensations that even doctors don't understand.	1	2	3	4	5
4. I am able to describe my feelings easily.	1	2	3	4	5
5. I prefer to analyze problems rather than just describe them.	1	2	3	4	5
6. When I am upset, I don't know if I am sad, frightened, or angry.	1	2	3	4	5
7. I am often puzzled by sensations in my body.	1	2	3	4	5
8. I prefer to just let things happen rather than to understand why they turned out that way.	1	2	3	4	5
9. I have feelings that I can't quite identify.	1	2	3	4	5
10. Being in touch with emotions is essential	1	2	3	4	5
11. I find it hard to describe how I feel about people.	1	2	3	4	5
12. People tell me to describe my feelings more.	1	2	3	4	5
13. I don't know what's going on inside me	1	2	3	4	5
14. I often don't know why I am angry.	1	2	3	4	5

15. I prefer talking to people about their daily activities rather than their feelings.	1	2	3	4	5
16. I prefer to watch “light” entertainment shows rather than psychological dramas.	1	2	3	4	5
17. It is difficult for me to reveal my innermost feelings, even to close friends.	1	2	3	4	5
18. I can feel close to someone, even in moments of silence.	1	2	3	4	5
19. I find examination of my feelings useful in solving personal problems.	1	2	3	4	5
20. Looking for hidden meanings in movies or plays distracts from their enjoyment.	1	2	3	4	5

Appendix 16: The Interpersonal Reactivity Index

Please indicate on the scale between one and four the degree that each statement describes you;

Item		(0) Does not describe me very well		(2) Neither		(4) Describes me very well
1	When I am reading an interesting story or novel, I imagine how I would feel if the events in the story were happening to me.	0	1	2	3	4
2	I really get involved with the feelings of the characters in a novel.	0	1	2	3	4
3	I am usually objective when I watch a movie or play, and I don't often get completely caught up in it.	0	1	2	3	4
4	After seeing a play or movie, I have felt as though I were one of the characters.	0	1	2	3	4
5	I daydream and fantasize, with some regularity, about things that might happen to me.	0	1	2	3	4
6	Becoming extremely involved in a good book or movie is somewhat rare for me.	0	1	2	3	4
7	When I watch a good movie, I can very easily put myself in the place of a leading character.	0	1	2	3	4
8	Before criticizing somebody, I try to imagine how I would feel if I were in their place.	0	1	2	3	4
9	If I'm sure I'm right about something, I don't waste much time listening to other people's arguments.	0	1	2	3	4
10	I sometimes try to understand my friends better by imagining how things look from their perspective.	0	1	2	3	4
11	I believe that there are two sides to every question and try to look at them both.	0	1	2	3	4
12	I sometimes find it difficult to see things from the other person's point of view.	0	1	2	3	4
13	I try to look at everybody's side of a disagreement before I make a decision.	0	1	2	3	4
14	When I'm upset at someone, I usually try to "put myself in their shoes" for a while.	0	1	2	3	4
15	When I see someone being taken advantage of, I feel kind of protective toward them.	0	1	2	3	4
16	When I see someone being treated unfairly, I sometimes don't feel very much pity for them.	0	1	2	3	4

Item		(0) Does not describe me very well		(2) Neither		(4) Describes me very well
17	I often have tender, concerned feelings for people less fortunate than me.	0	1	2	3	4
18	I would describe myself as a pretty soft-hearted person.	0	1	2	3	4
19	Sometimes I don't feel sorry for other people when they are having problems.	0	1	2	3	4
20	Other people's misfortunes do not usually disturb me a great deal.	0	1	2	3	4
21	I am often quite touched by things that I see happen.	0	1	2	3	4
22	When I see someone who badly needs help in an emergency, I go to pieces.	0	1	2	3	4
23	I sometimes feel helpless when I am in the middle of a very emotional situation.	0	1	2	3	4
24	In emergency situations, I feel apprehensive and ill-at-ease.	0	1	2	3	4
25	I am usually pretty effective in dealing with emergencies.	0	1	2	3	4
26	Being in a tense emotional situation scares me.	0	1	2	3	4
27	When I see someone get hurt, I tend to remain calm.	0	1	2	3	4
28	I tend to lose control during emergencies.	0	1	2	3	4

Appendix 17: Eating Disorder Examination Questionnaire- Adolescent

NAME:

.....

Date: ☐☐/☐☐/ 20

On how many days Of the past 14 days ...		no days	1-2 days	3-6 days	7 days	8-10 days	12-13 days	every day
1	...Have you been trying to cut down on food to control your weight or shape?	0	1	2	3	4	5	6
2	...Have you gone for long periods of time (8 hours or more) without eating anything to control your shape or weight?	0	1	2	3	4	5	6
3	...Have you tried not to eat any foods you like to control your weight and shape?	0	1	2	3	4	5	6
4	...Have you tried to keep to any strict rules about eating to control your shape or weight? For example,a calorie limit, a set amount of food, or rules about what and when you should eat?	0	1	2	3	4	5	6
5	...Have you wanted your stomach to be empty?	0	1	2	3	4	5	6
6	...Has thinking about food or calories made it much harder to concentrate on things you are interested in; for example, reading, watching tv, or doing your homework?	0	1	2	3	4	5	6
7	...Have you been scared of losing control over eating?	0	1	2	3	4	5	6
8	...Have you had eating binges?	0	1	2	3	4	5	6
9	...Have you eaten in secret? (Do not count binges.)	0	1	2	3	4	5	6
10	...Have you really wanted your stomach to be flat?	0	1	2	3	4	5	6

On how many days Of the past 14 days …		no days	1-2 days	3-6 days	7 days	8-10 days	12-13 days	every day
11	…Has thinking about shape or weight made it much harder to concentrate on things you are interested in; for example, reading, watching TV, or doing your homework?	0	1	2	3	4	5	6
12	…Have you been really scared that you might put on weight and get fat?	0	1	2	3	4	5	6
13	…Have you felt fat?	0	1	2	3	4	5	6
14	…Have you had a strong wish to lose weight?	0	1	2	3	4	5	6

OVER THE PAST TWO WEEKS (14 DAYS) ...

15	…How often have you felt guilty after eating becauseof the effect on your shape and weight? (Do not count binges) (Circle the number which applies)	0	None of the times
		1	A few of the times
		2	Less than half the times
		3	Half the times
		4	More than half the times
		5	Most of the time
		6	Every time
16	… Over the past two weeks (14 days), have there been any times when you have felt that you ate what other people would think was a very large amount of food given the situation? (Please circle).	0 - no	1- yes
17	…How many such times have you done this over the past two weeks?		
18	….During how many of these episodes of overeating did you have a sense of having lost control?		
19	Have there been other times when you felt that you lost control and felt you ate too much, but did NOT eat a very large amount of food given the situation? (Please circle)	0 - no	1- yes
20	…How many times has this happened over the past two weeks?		
21	Over the past two weeks have you made yourself sick (vomit) to control your shape or weight? (Please circle).	0 - no	1- yes
22	…How many such times have you done this over the past two weeks?		
23	….Have you taken laxatives to control your shape or weight? (Please circle)	0 - no	1- yes
24	How many times have you done this over the past two weeks?		
25	Have you taken diuretics (water tablets) to control your shape or weight? (Please circle)	0 - no	1- yes
26	How many times have you done this over the past two weeks?		
27	Have you exercised hard to control your shape or weight? (Please circle)	0 - no	1- yes
28	How many times have you done this over the past two weeks?		

OVER THE PAST 2 WEEKS (14 DAYS)..... (Please circle the number which best describesyour behaviour)		NOT AT ALL		SLIGHTLY	MODERATELY		MARKEDLY	
29	....Has your weight affected how you think about (judge) yourself as a person?	0	1	2	3	4	5	6
30	....Has your shape affected how you think about (judge) yourself as a person?	0	1	2	3	4	5	6
31	....How much would it upset you if you had to weigh yourself once a week for the next four weeks?	0	1	2	3	4	5	6
32	....How unhappy have you felt about your weight?	0	1	2	3	4	5	6
33	....How unhappy have you felt about your shape?	0	1	2	3	4	5	6
34	How worried have you been about other people seeing you eat?	0	1	2	3	4	5	6
35	.... How uncomfortable have you felt seeing your body: for example, in the mirror, in shop windows, when you undress or when you have a bath or shower?	0	1	2	3	4	5	6
36	....How uncomfortable have you felt about others seeing your body; for example, in shared changing rooms, when swimming or wearing tight clothes?	0	1	2	3	4	5	6

Appendix 18: Eating Disorder Flexibility Index

Instructions: The statements below are concerned with the past four weeks (28 days) only. Please read each statement and mark a cross in the box which most closely expresses your agreement or disagreement with the statement. Pleaseanswer all questions. There are no right or wrong answers.

		Strongly disagree	Disagree	Slightly disagree	Slightly agree	Agree	Strongly agree
1.	Even when I have decided what to eat, it is easy for me to eat something else.	☐	☐	☐	☐	☐	☐
2.	Before I can eat, the food has to be plated in a certain way.	☐	☐	☐	☐	☐	☐
3.	I have no specific eating rules that I have to follow.	☐	☐	☐	☐	☐	☐
4.	I think I handle changes well.	☐	☐	☐	☐	☐	☐
5.	I find it difficult to get used to new situations.	☐	☐	☐	☐	☐	☐
6.	Sudden changes make me distressed.	☐	☐	☐	☐	☐	☐
7.	If I am unable to weigh myself when I have planned to, I get distressed/anxious.	☐	☐	☐	☐	☐	☐
8.	If I start thinking about my body, I find it difficult to think about anything else.	☐	☐	☐	☐	☐	☐
9.	I have to exercise a certain number of minutes/ hours each day/week.	☐	☐	☐	☐	☐	☐
10.	I feel I have to follow a set exercise routine.	☐	☐	☐	☐	☐	☐
11.	I find it easy to do several things at once.	☐	☐	☐	☐	☐	☐
12.	When I start thinking about my weight, I find it difficult to think about anything else.	☐	☐	☐	☐	☐	☐
13.	When I am stuck on a task, I am unable to come up with new solutions.	☐	☐	☐	☐	☐	☐
14.	It bothers me when things don't go exactly as planned.	☐	☐	☐	☐	☐	☐
15.	From day to day, I am ok with eating my regular meals (breakfast, lunch and dinner) at different times.	☐	☐	☐	☐	☐	☐
16.	It's easy for me to adapt to changes in my environment (e.g. a new workplace / school/ home/ new friends/colleagues etc.).	☐	☐	☐	☐	☐	☐
17.	I get anxious or distressed if others interfere with my plans.	☐	☐	☐	☐	☐	☐
18.	If I start feeling fat, I cannot think of anything else.	☐	☐	☐	☐	☐	☐

		Strongly disagree	Disagree	Slightly disagree	Slightly agree	Agree	Strongly agree
19.	It is not important to me that a meal lasts a certain amount of time.	☐	☐	☐	☐	☐	☐
20.	It doesn't really matter where I eat (e.g. in the kitchen, in the living room, in front of the TV)	☐	☐	☐	☐	☐	☐
21.	I am open to new ways of doing things.	☐	☐	☐	☐	☐	☐
22.	I often try new types of food.	☐	☐	☐	☐	☐	☐
23.	If I have to, it's easy for me to change my plans.	☐	☐	☐	☐	☐	☐
24.	I have no problem with other people preparing or cooking my food.	☐	☐	☐	☐	☐	☐
25.	I find it difficult when something unexpected happens.	☐	☐	☐	☐	☐	☐
26.	I need my meals to be predictable (e.g. *when* I eat, type of food, food contents etc.).	☐	☐	☐	☐	☐	☐
27.	I find it difficult to consider a situation from several perspectives.	☐	☐	☐	☐	☐	☐
28.	If I think about food, body shape and weight, it is almost impossible for me to stop.	☐	☐	☐	☐	☐	☐
29.	I get distressed if I gain weight, no matter what I weigh.	☐	☐	☐	☐	☐	☐
30.	I am usually quite flexible.	☐	☐	☐	☐	☐	☐
31.	When things don't go according to plan, I am able to consider alternative solutions.	☐	☐	☐	☐	☐	☐
32.	I am a flexible person.	☐	☐	☐	☐	☐	☐
33.	Even when I have decided to work out, it's easy for me not to do it.	☐	☐	☐	☐	☐	☐
34.	I prefer eating the same foods as I usually do.	☐	☐	☐	☐	☐	☐
35.	I get angry or upset when people don't do things my way.	☐	☐	☐	☐	☐	☐
36.	There are usually a number of different ways of doing things.	☐	☐	☐	☐	☐	☐

Please check that you have answered all 36 questions. Thank you for filling in the questionnaire!

Appendix 19: Revised Children's Anxiety and Depression Scale

Child/ Young Person's NAME:

.....

Date: ☐☐/☐☐/ 20☐☐ **Time:** ☐☐ h ☐☐ m

Please put a circle around the word that shows how often each of these things happens to you.There are no right or wrong answers.

	1	I worry about things	Never	Sometimes	Often	Always
2		I feel sad or empty	Never	Sometimes	Often	Always
	3	When I have a problem, I get a funny feeling in my stomach	Never	Sometimes	Often	Always
4		I worry when I think I have done poorly at something	Never	Sometimes	Often	Always
	5	I would feel afraid of being on my own at home	Never	Sometimes	Often	Always
6		Nothing is much fun anymore	Never	Sometimes	Often	Always
	7	I feel scared when I have to take a test	Never	Sometimes	Often	Always
8		I feel worried when I think someone is angry with me	Never	Sometimes	Often	Always
	9	I worry about being away from my parent	Never	Sometimes	Often	Always
10		I am bothered by bad or silly thoughts or pictures inmy mind	Never	Sometimes	Often	Always
	11	I have trouble sleeping	Never	Sometimes	Often	Always
12		I worry that I will do badly at my school work	Never	Sometimes	Often	Always
	13	I worry that something awful will happen to someone in my family	Never	Sometimes	Often	Always
14		I suddenly feel as if I can't breathe when there is no reason for this	Never	Sometimes	Often	Always
	15	I have problems with my appetite	Never	Sometimes	Often	Always
16		I have to keep checking that I have done things right(like the switch is off, or the door is locked)	Never	Sometimes	Often	Always
	17	I feel scared if I have to sleep on my own	Never	Sometimes	Often	Always
18		I have trouble going to school in the morningsbecause I feel nervous or afraid	Never	Sometimes	Often	Always
	19	I have no energy for things	Never	Sometimes	Often	Always
20		I worry I might look foolish	Never	Sometimes	Often	Always

21	I am tired a lot	Never	Sometimes	Often	Always
22	I worry that bad things will happen to me	Never	Sometimes	Often	Always
23	I can't seem to get bad or silly thoughts out of my head	Never	Sometimes	Often	Always
24	When I have a problem, my heart beats really fast	Never	Sometimes	Often	Always
25	I cannot think clearly	Never	Sometimes	Often	Always

26	I suddenly start to tremble or shake when there is no reason for this	Never	Sometimes	Often	Always
27	I worry that something bad will happen to me	Never	Sometimes	Often	Always
28	When I have a problem, I feel shaky	Never	Sometimes	Often	Always
29	I feel worthless	Never	Sometimes	Often	Always
30	I worry about making mistakes	Never	Sometimes	Often	Always

31	I have to think of special thoughts (like numbers or words) to stop bad things from happening	Never	Sometimes	Often	Always
32	I worry what other people think of me	Never	Sometimes	Often	Always
33	I am afraid of being in crowded places (like shopping centers, the movies, buses, busy playgrounds)	Never	Sometimes	Often	Always
34	All of a sudden I feel really scared for no reason at all	Never	Sometimes	Often	Always
35	I worry about what is going to happen	Never	Sometimes	Often	Always

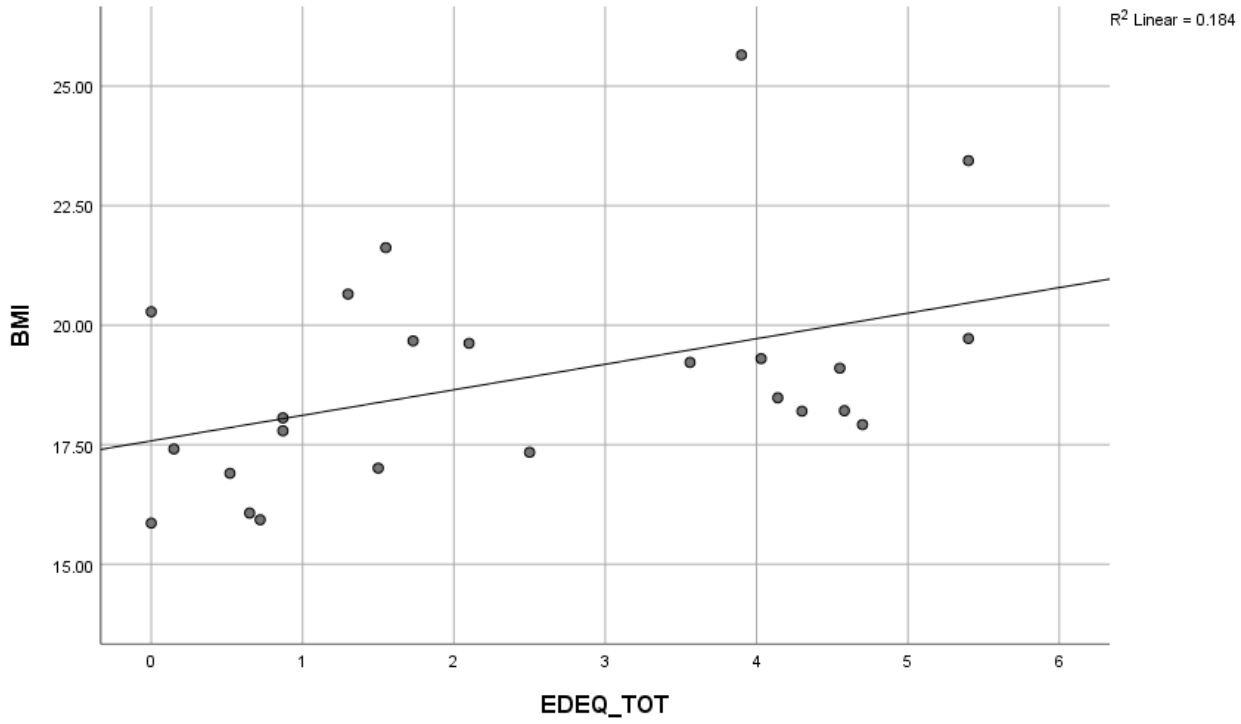
36	I suddenly become dizzy or faint when there is noreason for this	Never	Sometimes	Often	Always
37	I think about death	Never	Sometimes	Often	Always
38	I feel afraid if I have to talk in front of my class	Never	Sometimes	Often	Always
39	My heart suddenly starts to beat too quickly for no reason	Never	Sometimes	Often	Always
40	I feel like I don't want to move	Never	Sometimes	Often	Always

41	I worry that I will suddenly get a scared feeling when there is nothing to be afraid of	Never	Sometimes	Often	Always
42	I have to do some things over and over again (like washing my hands, cleaning or putting things in a certain order)	Never	Sometimes	Often	Always
43	I feel afraid that I will make a fool of myself in frontof people	Never	Sometimes	Often	Always
44	I have to do some things in just the right way to stop bad things from happening	Never	Sometimes	Often	Always
45	I worry when I go to bed at night	Never	Sometimes	Often	Always

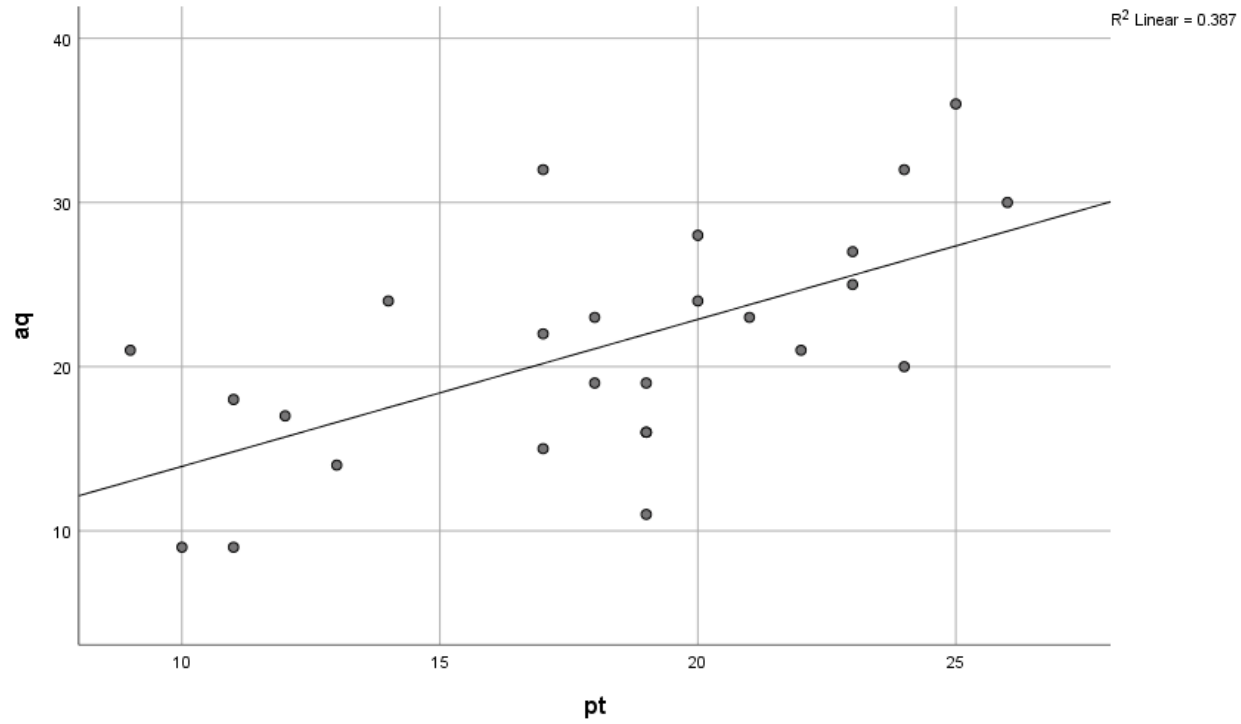
46	I would feel scared if I had to stay away fromhome overnight	Never	Sometimes	Often	Always
47	I feel restless	Never	Sometimes	Often	Always

Appendix 20: Empirical research study scatter plots

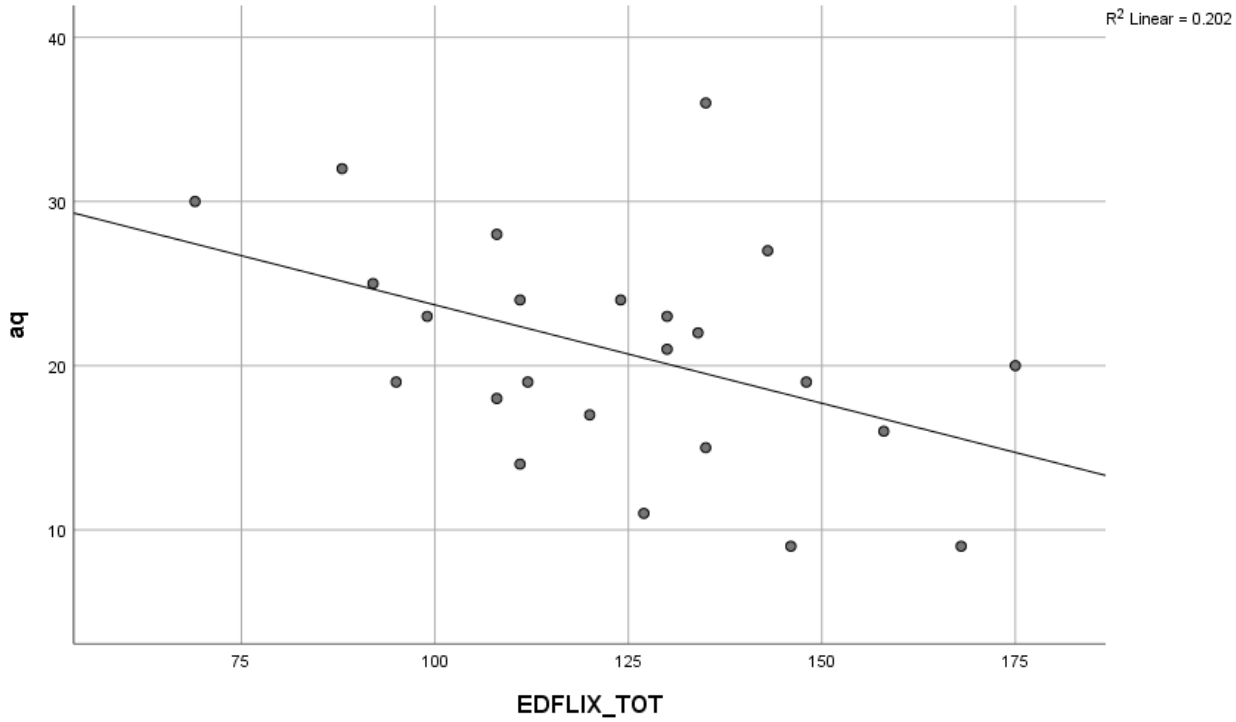
BMI and EDEA-Q



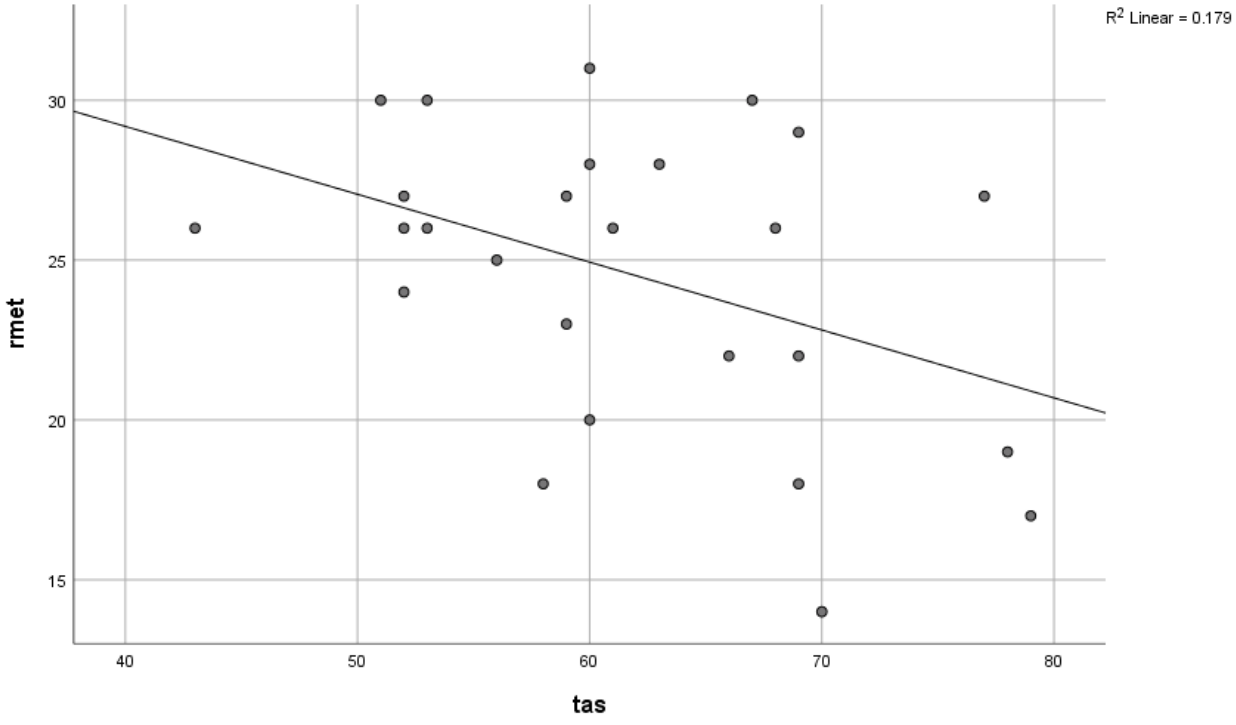
AQ and Perspective Taking



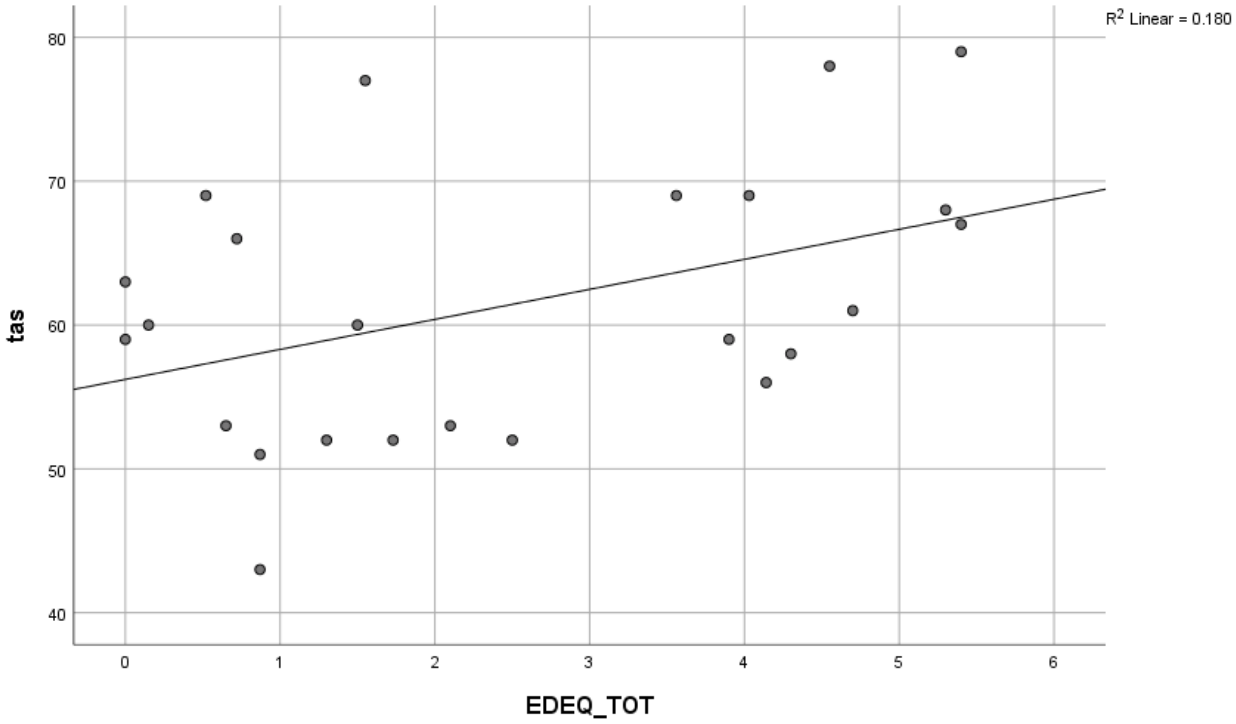
AQ and EDFLIX



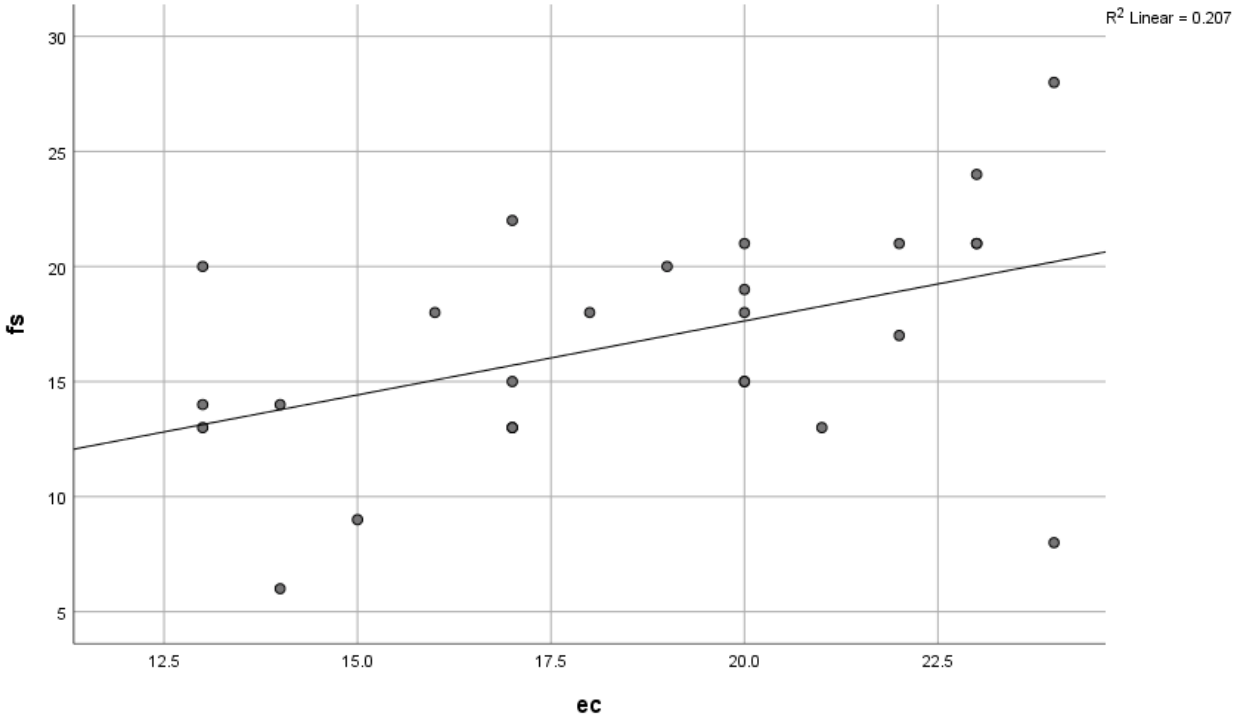
RMET and TAS Total



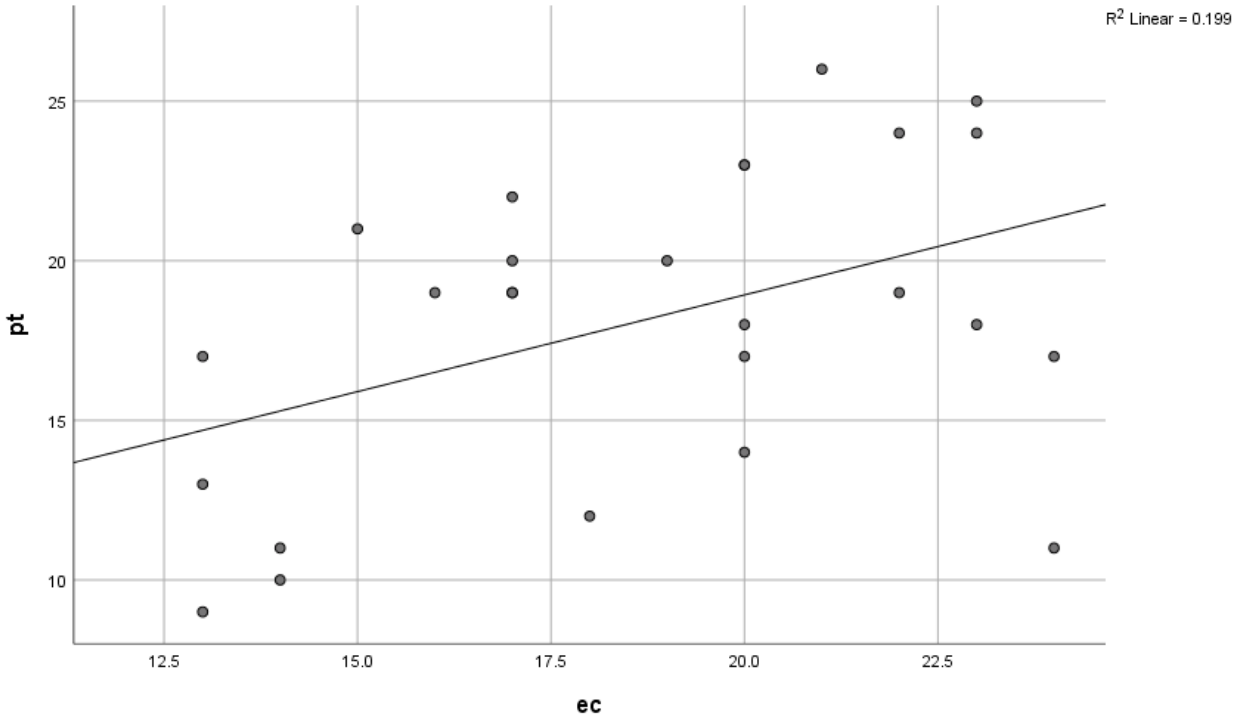
TAS Total and EDEA-Q



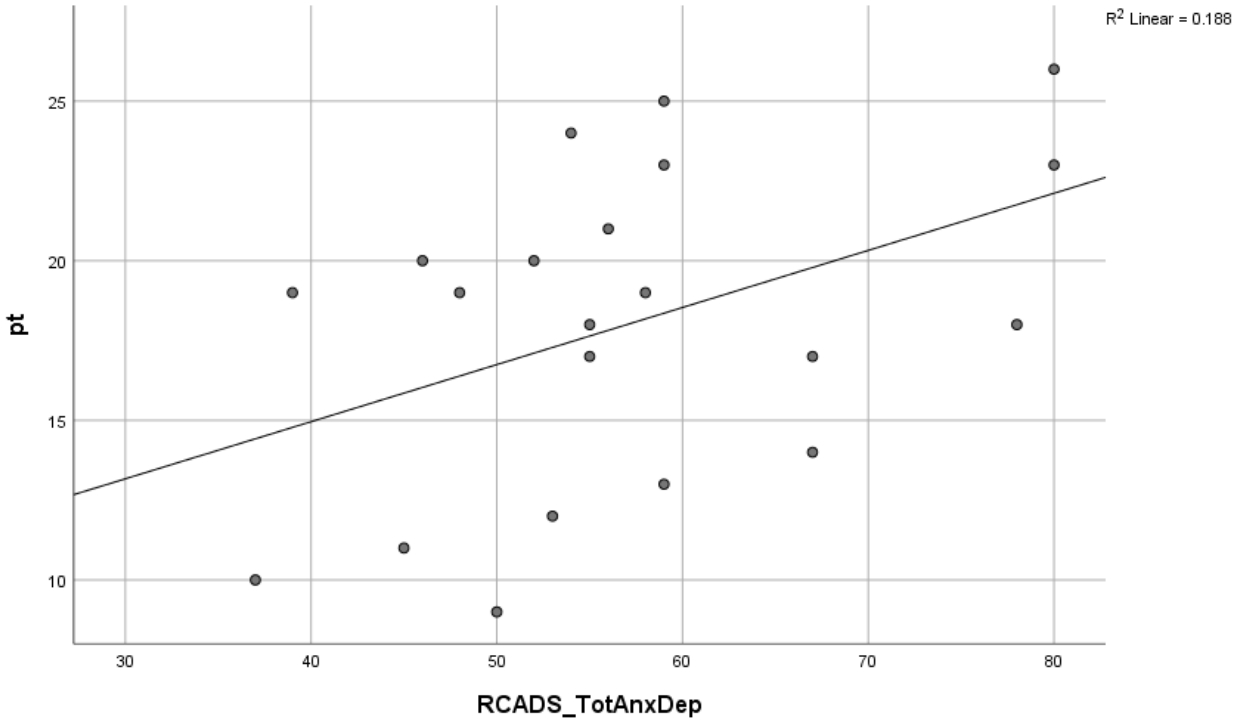
Fantasy and Empathetic Concern



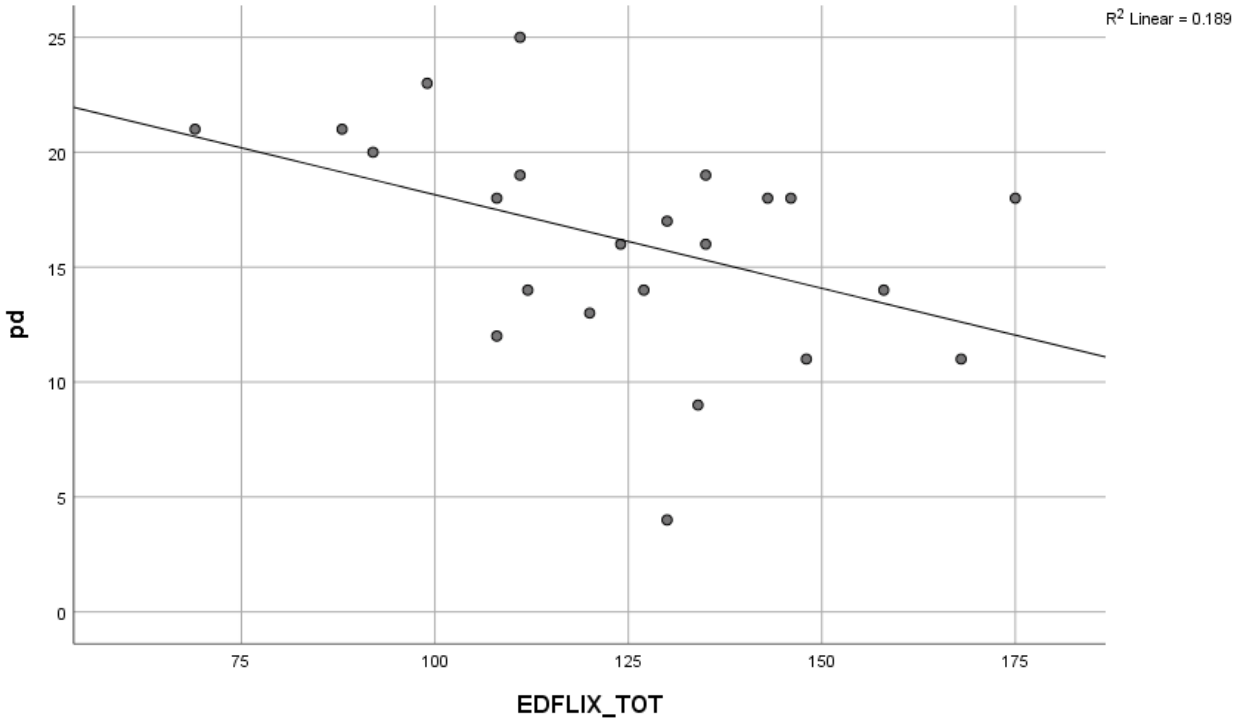
Perspective Taking and Empathetic Concern



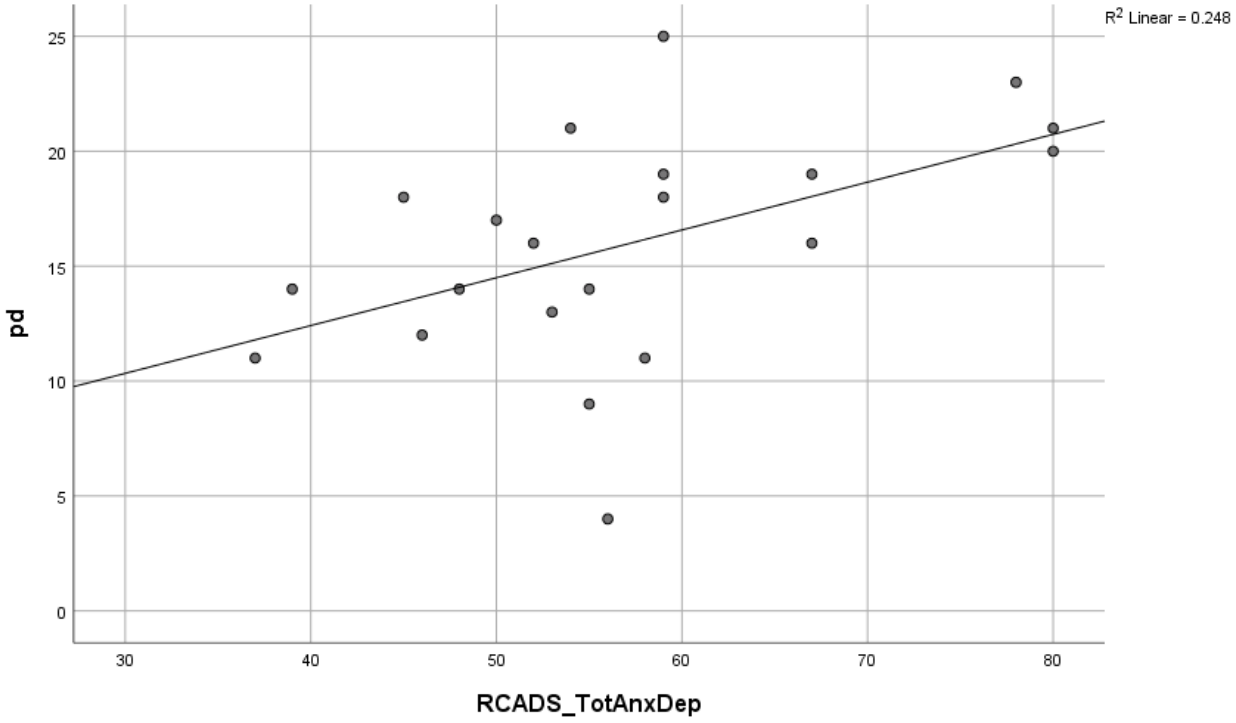
Perspective Taking and Total Anxiety and Depression



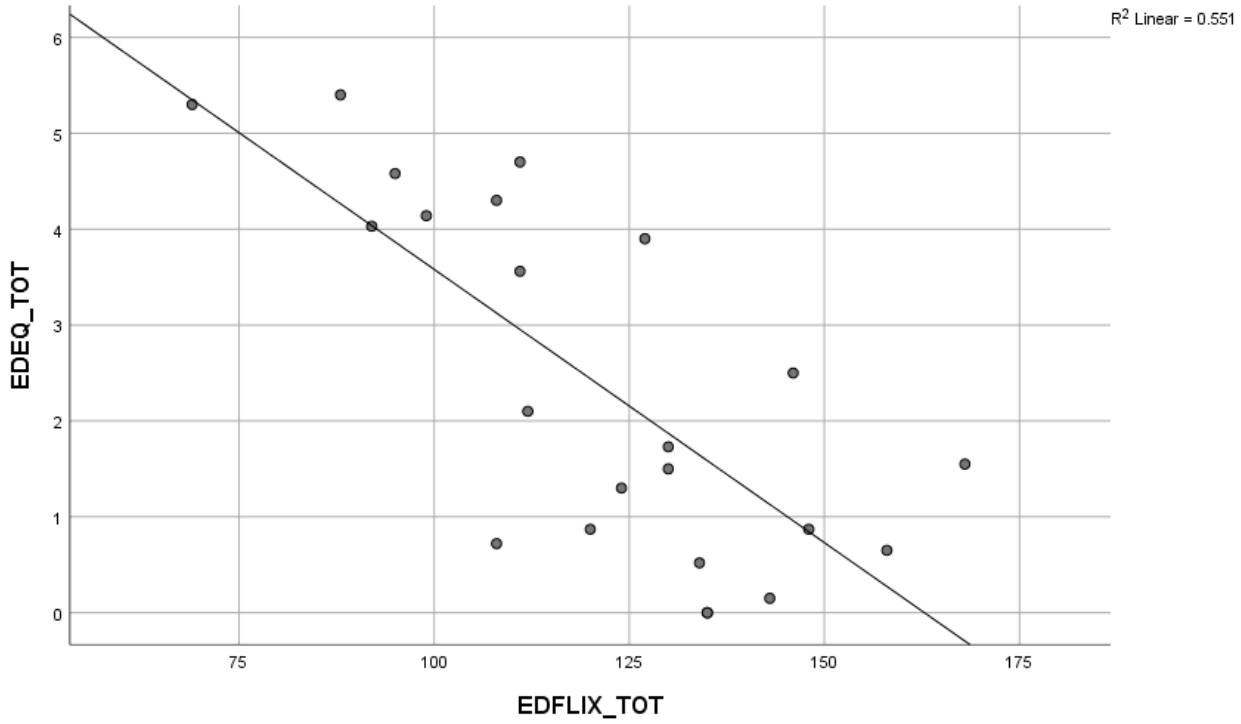
Personal Distress and EDFLIX Total



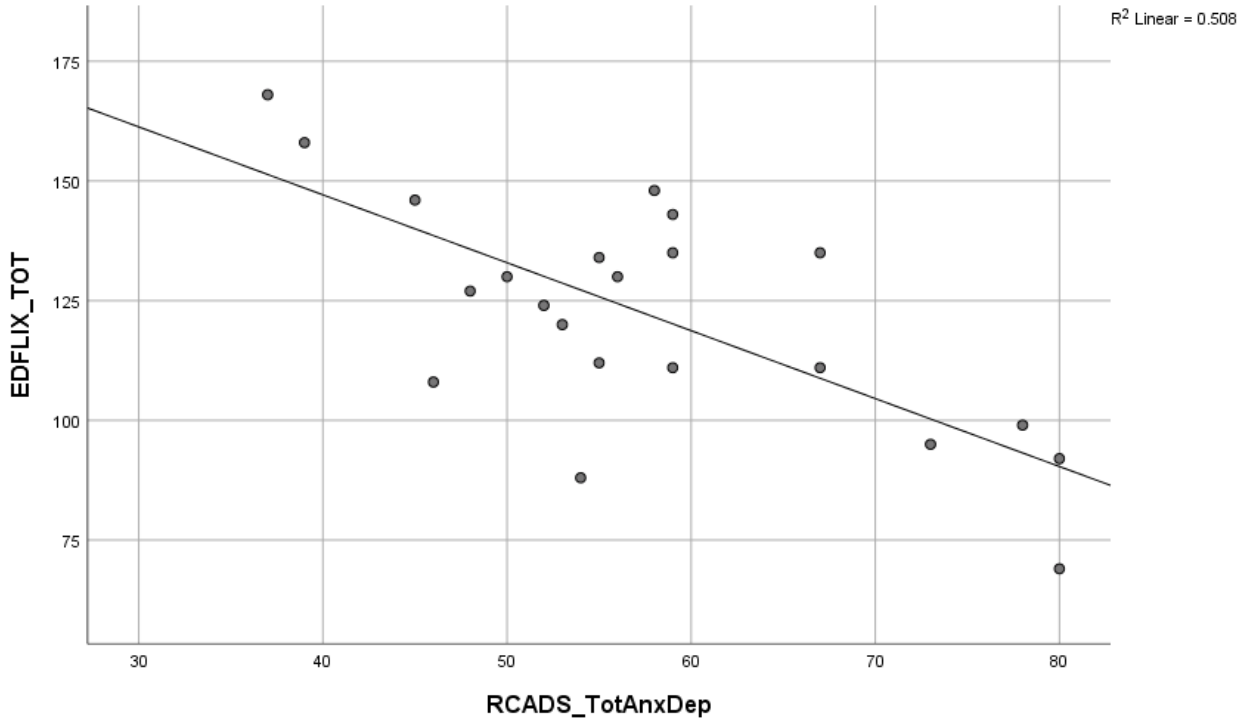
Personal Distress and Total Anxiety and Depression



EDEA-Q and EDFLIX



EDFLIX and Total Anxiety and Depression



Appendix 21: International Journal of Eating Disorders Author Guidlines

1. SUBMISSION

Authors should kindly note that submission implies that the content has not been published or submitted for publication elsewhere except as a brief abstract in the proceedings of a scientific meeting or symposium. If there is a related paper under consideration at another journal, a copy of that paper should be submitted with the primary manuscript as supporting information.

International Journal of Eating Disorders will consider submissions that have previously been made available online, either on a preprint server like arXiv, bioRxiv, or PeerJ PrePrints, or on the authors' own website. However, any such submissions must not have been published in a scientific journal, book or other venue that could be considered formal publication. Authors must inform the editorial office at submission if their paper has been made available as a preprint.

- Authors of accepted papers that were made available as preprints must be able to assign copyright to *International Journal of Eating Disorders*, or agree to the terms of the Wiley Open Access agreement and pay the associated fee
- Given that the measurable impact of the article is diminished when citations are split between the preprint and the published article, authors are required to:
    - Update the entry on the preprint server so that it links to and cites the DOI for the published version
    - Cite only the published article themselves

Authors should follow the guidelines carefully; failure to do so will delay the processing of the manuscript. **Once the submission has been prepared in accordance with the Author Guidelines, manuscripts should be submitted online at mc.manuscriptcentral.com/ijed**. Authors unfamiliar with ScholarOne can find details on how to use the system here: **www.wileyauthors.com/scholarone**.

The submission system will prompt the author to use an ORCID iD (a unique author identifier) to help distinguish their work from that of other researchers. Details can be found **elsewhere** in these guidelines.

By submitting a manuscript to or reviewing for this publication, an individual's name, email address, and affiliation, and other contact details the publication might require, will be used for the regular operations of the publication, including, when necessary, sharing with the publisher (Wiley) and partners for production and publication. The publication and the publisher recognize the importance of protecting the personal information collected from users in the operation of these services, and have practices in place to ensure that steps are taken to maintain the security, integrity, and privacy of the personal data collected and

processed. You can learn more at **authorservices.wiley.com/statements/data-protection-policy**.

Preprint policy:

Please find the Wiley preprint policy **here.**

This journal accepts articles previously published on preprint servers.

International Journal of Eating Disorders will consider for review articles previously available as preprints. Authors may also post the submitted version of a manuscript to a preprint server at any time. Authors are requested to update any pre-publication versions with a link to the final published article.

For help with submissions, authors should contact the Editorial Office: **ijed@wiley.com**. When necessary, the Editorial Office staff may refer questions to the Editor-in-Chief or Associate Editors.

Return to Guideline Sections

2. AIMS AND SCOPE

The *International Journal of Eating Disorders*—A leading peer-reviewed journal in the fields of psychology, psychiatry, public health, and nutrition & dietetics.

Mission: With a mission to advance the scientific knowledge needed for understanding, treating, and preventing eating disorders, the *International Journal of Eating Disorders* publishes rigorously evaluated, high-quality contributions to an international readership of health professionals, clinicians, and scientists. The journal also draws the interest of patient groups and advocates focused on eating disorders, and many of the articles draw attention from mainstream media outlets.

Scope: Articles featured in the journal describe state-of-the-art scientific research on theory, methodology, etiology, clinical practice, and policy related to eating disorders, as well as contributions that facilitate scholarly critique and discussion of science and practice in the field. Theoretical and empirical work on obesity or healthy eating falls within the journal's scope inasmuch as it facilitates the advancement of efforts to describe and understand, prevent, or treat eating disorders. The *International Journal of Eating Disorders* welcomes submissions from all regions of the world and representing all levels of inquiry (including basic science, clinical trials, implementation research, and dissemination studies), and across a full range of scientific methods, disciplines, and approaches.

A complete **overview** of the journal is given elsewhere on the journal's homepage.

Return to Guideline Sections

3. MANUSCRIPT CATEGORIES AND REQUIREMENTS

The *International Journal of Eating Disorders* publishes the following contribution types:

1. Original Articles
2. Brief Reports

3. Intervention Studies
4. Reviews
5. Spotlight
6. Commentaries
7. Registered Reports
8. Forum
9. Perspective

When uploading their manuscript, authors will be asked to complete a checklist indicating that they have followed the Author Guidelines pertaining to the appropriate article type. For all manuscripts reporting statistical analyses, authors are advised to use the **Statistical Reporting Checklist.** For more detailed background information on statistical analyses and their rationale, authors are referred to the **IJED Statistical Reporting Guidelines.** Manuscript with incomplete reporting will be referred back to the author without review. All word limits relate to the body of the text (i.e., not including abstract, references, tables and figures) and represent maximum lengths. Authors are encouraged to keep their manuscript as short as possible while communicating clearly.

1) Original Articles

These contributions report substantive research that is novel, definitive, or complex enough to require a longer communication. Only a subset of research papers is expected to warrant full-length format.

- Word Limit: 4,500 (excluding abstract, references, tables or figures)
- Structured Abstract: 250 words.
- References: ≤60 are recommended; more are permissible, for cause.
- Figures/Tables: a maximum of 8 essential tables/figures, overall.

When preparing their manuscript, authors should follow the IMRaD guidelines (***I***ntroduction, ***M***ethods, ***R***esults, ***a***nd ***D***iscussion), which are recommended by the International Committee of Medical Journal Editors (ICMJE) (**J. Pharmacol. Pharmacother. 2010, 1, 42–58**).

2) Brief Reports

This contribution type is intended for manuscripts describing studies with straightforward research designs, pilot or "proof of concept" studies, and replications.

- Word Limit: 2,000 (excluding abstract, references, tables or figures).
- Structured Abstract: 200 words.
- References: ≤20 are recommended; more are permissible, for cause.
- Figures/Tables: a maximum of 2 essential tables/figures, overall.

As for **Original Articles**, when preparing their manuscript, authors should follow the IMRaD guidelines.

3) Intervention Studies

Unless noted otherwise, all interventions studies require that authors have preregistered their study in an online repository before the first participant has been enrolled. The preregistration number should be entered in the manuscript submission checklist and also be reported in the Methods section. Examples of repositories include https://cos.io/prereg/, https://www.clinicaltrials.gov/, etc.

Intervention studies will be accepted under one of two broad categories, reflecting the processes outlined in the literature for research into clinical interventions. They can include prevention, early intervention and treatment studies.

When submitting an intervention study manuscript, authors first should determine whether the study warrants a full-length report (**Original Articles** format) or whether it best fits the **Brief Reports** format.

Upon selecting the manuscript format, authors will then be able to select whether the manuscript describes a) an innovation or implementation study; b) a comparative treatment or prevention trial; or c) a non-intervention study (i.e. all other studies).

In all cases, ethical considerations should be addressed, including the obtaining of ethical permission where required. Statistical analysis and data presentation should be appropriate and follow the guidelines for statistical reporting provided for IJED contributors (including treatment of missing data). Any presentation of post-hoc findings needs to be clearly justified and contextualized. The inclusion of qualitative feedback on the experience of patients and clients is encouraged.

Innovation and Implementation

Such papers demonstrate the potential of new innovations in treatment for eating disorders, and the effectiveness of strongly evidenced therapies in routine clinical settings. Those papers are expected to meet the standards included for Template Intervention Description and Replication Checklist (TIDieR): **http://www.equator-network.org/wp-content/uploads/2014/03/TIDieR-Checklist-PDF.pdf**

Single case experimental designs, where one or more cases are presented using visual or statistical methods to demonstrate the clinical impact of an intervention, based on at least an A-B design and session-by-session data. Such case reports should have heuristic value, so need to be innovative and leading to stronger research. Such cases require a clear statement from the authors that the patient (or the patient's legal guardian) has given permission to publish the material anonymously. Case reports without such clinical outcome data and structured presentation of findings will not normally be considered. Preregistration encouraged but not required.

Innovative uncontrolled trials, using a case series to demonstrate the initial implementation of interventions, under uncontrolled conditions (e.g., a series of patients treated with a new therapy; a comparison of therapies for similar but not identical patients). Such case series should be placed in context (e.g., were the patients recruited as a true series, or were they

selected from the available pool?) and supported with a CONSORT diagram or the appropriate procedural detail. Preregistration encouraged but not required.

Implementation studies, effectiveness studies, demonstrating the rolling out of evidence from controlled trials to routine practice, other populations, etc. Differences relative to the original intervention should be outlined.

For both study types, reporting of intent-to-treat results is preferred unless a strong rationale for a different approach is provided. Completer results can also be reported if this is considered to add important information. Results should include the mean and SD of pre- and post-scores, within-group effect sizes with 95% confidence intervals, and pre- and post-score correlations (allowing within-subject effect sizes to be verified). Appropriate follow-up data are desirable.

Comparative Trials

This category requires evidence that an intervention has been compared to either a control or active condition and has been conducted and reported appropriately in conformity to the appropriate CONSORT checklist (**http://www.consort-statement.org/**), particularly randomization of participants. CONSORT diagrams will usually be required, and such trials should be pre-registered to ensure that the core aims and hypotheses are openly addressed. Replication studies are welcomed but are more likely to be suited to Brief Reports.

Proof of concept and pilot studies are not required before an RCT can be published. However, each of these types of study is accepted by IJED, as they form key steps in the development of ideas, grant proposals, etc. Proof of concept and pilot studies can be combined into one submission, but both functions should be addressed adequately in that paper in such a case. The study description should conform to the CONSORT 2010 checklist of information to include when reporting a proof of concept or pilot study trial. Authors are advised to review the CONSORT extensions for additional information **http://www.consort-statement.org/extensions**.

Proof of concept studies answer the question: Does the RCT pose questions well worth asking? Data can be presented on effectiveness but should not be used to estimate effect sizes for the RCT as such estimates can be misleading. Preregistration encouraged but not required.

Pilot studies assess issues related to proposed sampling and measurement, design and analysis and answer the question: Is the RCT well-designed enough to address the hypotheses? Such studies should report feasibility as the primary outcome rather than clinical outcomes. This requires a focus on information that addresses hypotheses about recruitment, acceptability, attrition, cost, accessibility, e.g., Can you recruit as many participants in the time allowed as your study proposes? Will the participants accept randomization? Will they comply with treatment protocols? Is the protocol for delivery of treatment well and clearly enough defined to promote fidelity? Will the participants accept the testing procedures? Can the testing procedures be completed in the time allowed? If these data are included in any subsequent study (e.g., an RCT), that fact should be explained transparently.

Randomized controlled trials, where there needs to be an adequate sample size (demonstrated through the presentation of a power analysis), clear aims and hypotheses. Any blinding (e.g., of researchers) and problems of de-blinding should be clearly detailed. An appropriate

follow-up period is required. Definitions of terms such as 'attrition', 'remission' and 'recovery' should be fully replicable, and intervention protocols should be readily available to the reader. The study description should conform to the CONSORT 2010 checklist of information to include when reporting a randomized trial.

4) Reviews

These articles critically review the status of a given research area and propose new directions for research and/or practice. Both systematic and meta-analytic review papers are welcomed if they review a literature that is advanced and/or developed to the point of warranting a review and synthesis of existing studies. Reviews of topics with a limited number of studies are unlikely to be deemed as substantive enough for a Review paper. The journal does not accept papers that merely describe or compile a list of previous studies without a critical synthesis of the literature that moves the field the forward.

- Word Limit: 7,500 (excluding abstract, references, tables or figures).
- Structured Abstract: 250 words.
- References: ≤100 are recommended; more are permissible, for cause.
- Figures/Tables: no maximum, but should be appropriate to the material covered.

All Review articles must follow the PRISMA Guidelines (**www.prisma-statement.org**), summarized in a 2009 *J. Clin. Epidemiol.* article by Moher et al. entitled *"Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement"* (DOI: **10.1016/j.jclinepi.2009.06.005**), freely available for download in both English and Spanish.

In addition to the required PRISMA review paper components, all review articles must also include a full description of the age, gender, race, ethnicity, and socioeconomic status of participants in the reviewed studies. This information will most often take the form of separate entries in tables describing the studies included in the review. Review papers must also explicitly discuss (in the text) the diversity of the samples and the ways in which this diversity may impact the generalizability and representativeness of the study results and conclusions.

Authors who choose this contribution type must complete the Review Checklist upon submission of the manuscript, an example of which can be found **here**). This example is for informational purposes only. During the submission process, authors will be prompted to complete the Review Checklist directly in ScholarOne. The rationale for any unchecked items on the Review Checklist must be explicitly described in the accompanying Cover Letter.

5) Spotlight

This is a contribution type where authors propose an idea that may not yet have adequate empirical support or be ready for full empirical testing, but holds great promise for advancing research of eating disorders. Authors are encouraged to write a piece that is bold, forward looking, and suggestive of new and exciting avenues for research and/or practice in the field. The manuscript should identify the specific knowledge gap and why filling the gap will

advance research and practice in the field; it should delineate several concrete steps for addressing the gap.

- Word Limit: 2,000 (excluding abstract, references, tables or figures).
- Unstructured Abstract: 200 words.
- References: ≤20 are recommended; more are permissible, for cause.
- Figures/Tables: a maximum of 2 essential tables/figures, overall.

6) Commentaries

Commentaries are solicited by the Editors when multiple perspectives on or critical appraisal of an article would assist in placing that article in context. Unsolicited commentaries are not considered for publication.

- Word Limit: 2,000 (excluding abstract, references, tables or figures).
- Unstructured Abstract: 200 words.
- References: ≤5 are recommended, more are permissible for cause.
- Figures/Tables: none.

7) Registered Reports

This manuscript type is intended for publishing a detailed research protocol of original empirical studies prior to commencing data collection or of studies involving secondary data analyses of large public access data bases, prior to commencing analyses. The journal will not consider Registered Reports for analyses that may reasonably be expected to be conducted as part of a complex research study (e.g., moderator/mediator analyses in a treatment trial). The journal does not support Registered Reports for meta-analytic or systematic reviews.

Registered Reports manuscripts should use section headings under which authors provide the following information. Introduction: Study aim(s) and background literature, and statement of hypotheses. The introduction would provide a succinct and compelling rationale for the study. Methods: Experimental design and procedures, analysis plans, and statistical power analysis. The methods section should be written with the goal of facilitating study replication and describe in detail, where possible or applicable, recruitment target numbers, criteria and procedures; instruments or other materials; experimental stimuli and procedures; intervention protocols; analysis scripts or code; etc. Preliminary Data (if applicable): any pilot data. Conclusion: a concise statement regarding the expected knowledge to be gained.

Authors are advised of the following additional requirements:

1. By the time of submission of the registered report manuscript, authors will have completed a preregistration of their study in an online repository (e.g., cos.io/prereg/); authors report the preregistration number as part of the submission process (on the author checklist) and in the methods section. If the preregistration is embargoed at the time of submission, authors should attach for the editor a confidential file containing the preregistration information and date when the study was preregistered.

2. If the preregistration is embargoed, the embargo must be lifted at the of acceptance of the Registered Report.
3. Having received extramural funding is not a prerequisite to potential acceptance of the registered report. However, authors are required to indicate in their submission letter whether the research plan has been reviewed and approved for funding by an extramural funding organization.
4. While institutional review board (IRB) approval is not required at the time of submission, publication will be conditional on receipt of IRB approval for the research plan as described in the accepted manuscript.

Registered Reports are peer reviewed using the same review criteria and procedures as apply to the introduction and methods sections of empirical studies involving confirmatory hypothesis testing. Reviewers would evaluate whether the rationale for the study aims is well justified and whether the design and methods are appropriate for testing the hypotheses.

Registered Reports manuscripts meeting the rigorous and transparent requirements for conducting the research proposed will be accepted for publication.

In addition, authors of a published Registered Report manuscript will be offered an in-principle acceptance of a subsequently submitted (Stage 2) manuscript. Specifically, following data collection, authors may submit a Stage 2 manuscript that includes the introduction and methods from the original submission plus their obtained results and discussion. All planned analyses and resulting findings should be reported. Authors choosing to include in their Stage 2 manuscript unplanned analyses will need to clearly distinguish them from planned analyses. Authors may select the Original Report format or, if indicated, the Brief Report format. In either case, authors should update their manuscript considering the literature that has become available since publication of the Registered Report.

The Stage 2 manuscript will undergo full review. Referees will consider whether the authors properly executed the study and adhered precisely to the registered research procedures and analysis plans. Referees will review any unregistered post hoc analyses added by the authors to confirm they are justified, methodologically sound and informative. Finally, the referees will evaluate the scholarly quality of the discussion.

Submission of the Stage 2 manuscript to IJED is optional; authors are free, therefore, to publish their completed study in any journal of their choosing. Authors who opt to submit their stage 2 manuscript to IJED should select the Original Studies or Brief Report format. Stage 2 manuscripts published in IJED will be eligible for the "Preregistered" Open Science badge: **https://cos.io/our-services/open-science-badges/**

Should the author choose to publish their Registered Research Report open access and should the article be accepted for publication, a 50% discount is applied on the Article Publication Fee at both stages of publication.

Throughout the process, the journal editor or associate editors retain the right to reject manuscripts where the quality of academic writing is deemed not to be of a publishable standard.

Registered Reports Stage 1 Details:

Word Limit: 3,000 (excluding abstract, references, tables or figures); much of the word count should be devoted to a detailed description of study methods and procedures.

- Title page: Include preregistration information.
- Unstructured abstract: 200 words.
- References: ≤30 recommended; more are permissible, for cause.
- Figures/Tables: a maximum of 4 essential tables/figures, overall. Authors are encouraged to summarize key methodological details in table or figure format.
- Supplemental information. For lengthy information that cannot be accommodated within the word limit of the Registered Report format, authors are encouraged to utilize publicly accessible repositories and report the relevant hyperlinks in their methods section.

Registered Reports Stage 2 Details

Authors should use instructions for Original Studies or Brief Report manuscripts, respectively.

8) Forum

A Forum manuscript introduces an important knowledge or practice gap in regards to preventive or clinical interventions, policies, or research methods in the field and proposes specific solutions to filling the gap. A Forum manuscript is grounded in expert review of the literature and presents novel ideas regarding prevention or clinical care (Clinical Forum), public health or health care policy (Policy Forum), or research methods (Research Forum). Unlike Systematic Reviews or Meta-Analytical Reviews ("Review manuscripts"), the literature reviewed in a Forum manuscript may involve a smaller number of studies (i.e., the field may not yet have matured to the point where a systematic review is indicated); however, as in Review manuscripts, authors need to describe and critically discuss the relevant details of the prior literature. Unlike Idea manuscripts, Forum manuscripts need not necessarily pose a novel problem; the gap or problem being addressed may have plagued the field for some time. What is expected to be novel is (are) the solution(s) being proposed in the Forum manuscript. As with all journal content, authors should consider the relevance and implications of their work for a global audience.

When submitting the Forum, authors will be prompted to select whether their Forum manuscript primarily focuses on treatment or prevention (Clinical Forum), public health or health care policy (Policy Forum), or research methods (Research Forum).

Main text, excluding abstract, references, tables or figures: 5000 words

Structured abstract: 250 words

Tables, figures: up to 5

References: no restriction

9) Perspective

A Perspective manuscript comments on an Original Research, Brief Report, or Meta-Analysis Review manuscript published in the IJED. A Perspective expands upon the published research by offering additional context, interpretation, or suggestions regarding the potential application of the research for advancing science and practice in eating disorders. Perspective manuscripts may not merely summarize the published research nor are they intended to primarily discuss the author's own work. Because the Original Research, Brief Report, or Meta-Analysis paper has already been peer reviewed, the Perspective manuscript should be viewed as an opportunity to develop the ideas and potential of the work reported, rather than a critique of the paper. Indeed, only submissions that add a new dimension to the published research will be considered suitable for publication.

Perspective manuscripts should provide a personal viewpoint and, as such, authorship should be limited to one or two authors. We recognize various forms of expertise, including research expertise, clinical expertise, expertise by lived experience (e.g., individuals impacted by an eating disorder), policy expertise, or expertise in a scholarly field distinct from eating and weight disorders. When submitting a Perspective manuscript, authors are requested to specify their primary expertise as pertaining to the Perspective submission.

To be considered for publication, the Perspective should focus on an Original Research, Brief Report, or Meta-Analysis Review manuscript that has been published in early view no more than three months before submission of the Perspective manuscript. Submissions that do not meet these requirements are rejected without review.

Main text: up to 750 words.

No abstract, up to 10 references.

Return to Guideline Sections

4. PREPARING THE SUBMISSION

Parts of the Manuscript

The submission should be uploaded in separate files: 1) **manuscript file**; 2) tables; 3) **figures**; 4) if applicable, **supporting Information file(s)**.

1. Manuscript File

The text file should contain the manuscript text, references, and the figure legends. The text should be presented in the following order:

1. Title page

1. Title. The title should be short and informative, containing major keywords related to the content. The title should not contain abbreviations (see Wiley's best practice SEO tips) and should not be phrased inform of a question.
2. A short running title of less than 40 characters.
3. The full names of all authors
4. The authors' institutional affiliations where the work was conducted, with a footnote for an author's present address if different to where the work was carried out
5. If applicable (required for clinical trials): Trial registration number.
6. Word counts (abstract and main text, excl. tables and references)

2. Data Availability Statement
3. Acknowledgements and Conflicts of Interest
    1. If applicable: funding source
    2. If applicable: other acknowledgements
    3. Conflict of interest statement (if none, state "The authors have no conflict to declare")
4. Abstract and Keywords
5. Main text
6. References
7. Figure legends

Title Page

Authorship

For details on eligibility for author listing, please refer to the journal's **Authorship policy** outlined in Section 5 of these Author Guidelines.

Acknowledgments

Contributions from individuals who do not meet the criteria for authorship should be listed, with permission from the contributor, in an Acknowledgments section. Financial and material support should also be mentioned. Thanks to anonymous reviewers are not appropriate.

Conflict of Interest Statement

Authors will be asked to provide a conflict of interest statement during the submission process. See the journal's policy on **Conflict of Interest** outlined in Section 5 of these Author Guidelines. Authors should ensure they liaise with all co-authors to confirm agreement with the final statement.

Abstract

The abstract should be typed as a single paragraph. The word maximum and abstract format vary by contribution type (see above).

Structured abstracts should be organized as follows: **Objective**: briefly indicate the primary purpose of the article, or major question addressed in the study. **Method**: indicate the sources of data, give brief overview of methodology, or, if review article, how the literature was searched and articles selected for discussion. For research based articles, this section should briefly note study design, how participants were selected, and major study measures. **Results**: summarize the key findings. **Discussion**: indicate main clinical, theoretical, or research applications/implications.

Keywords

Please provide about 10 keywords. Keywords should be taken from those recommended by the US National Library of Medicine's Medical Subject Headings (MeSH) browser list at **www.nlm.nih.gov/mesh**.

Main Text

- Manuscripts reporting original research should follow the **IMRaD guidelines** (***I***ntroduction, (***M***ethods, ***R***esults, ***a***nd ***D***iscussion), which are recommended by the International Committee of Medical Journal Editors (ICMJE) (J. Pharmacol. Pharmacother. 2010, 1, 42–58).
- The Methods section should include a statement about sample selection, response rate, and other factors that would impact selection or response bias and, in turn, representativeness of the sample.
- Articles reporting data taken from or deposited elsewhere should refer to the journal policy on Data Storage and Documentation in Section 5 (below).
- If the study involves qualitative data, authors need to include a statement about sample size in relation to theme saturation. It is also important that the sampling strategy is driven by theory rather than convenience, the data analysis procedures are justified, and the advantage of a qualitative (vs. a simple quantitative) approach are well-described.
- For additional detail regarding statistical requirements for the manuscript see **IJED Statistical Reporting Guidelines** and please use the **Statistical Reporting Guidelines Checklist** as you prepare your manuscript.
- Authors should refrain from using terms that are stigmatizing or terms that are ambiguous. For further explanation and examples, see the 2016 IJED article by Weissman et al. entitled "*Speaking of that: Terms to avoid or reconsider in the eating disorders field*" (DOI: 10.1002/eat.22528.)
- To facilitate evaluation by the Editors and Reviewers, each manuscript page should be numbered; the text should be double-spaced; and line numbers should be applied (restarting from 1 on each page). Instructions on how to implement this feature in Microsoft Word are given here.

- The journal uses US spelling. Authors may submit using any form of English as the spelling of accepted papers is converted to US English during the production process.
- Footnotes to the text are not allowed and any such material should be incorporated into the text as parenthetical matter.
- It is the primary responsibility of the authors to proofread thoroughly and ensure correct spelling and punctuation, completeness and accuracy of references, clarity of expression, thoughtful construction of sentences, and legible appearance prior to the manuscript's submission.
- Authors for whom English is not their first language are encouraged to seek assistance from a native or fluent English speaker to proof read the manuscript prior to submission. Wiley offers a paid service that provides expert help in English language editing—further details are given below.
- Articles reporting data taken from or deposited elsewhere should refer to the journal policy on Data Storage and Documentation in Section 5 (below).

References

References in all manuscripts should follow the style of the American Psychological Association (6th edition), except in regards to spelling. The APA website includes **a range of resources for authors learning to write in APA style**, including **An overview of the Publication Manual of the American Psychological Association, Sixth Edition**; includes **free tutorials on APA Style basics** and an **APA Style Blog**. Please note APA referencing style requires that a Digital Object Identifier (DOI) be provided for all references where available.

Tables

Each table must be numbered in order of appearance in the text with Arabic numerals and be cited at an appropriate point in the text. Tables should be self-contained and complement, not duplicate, information contained in the text. They should be editable (i.e., created in Microsoft Word or similar), not pasted as images. Legends should be concise but comprehensive—the table, legend, and footnotes must be understandable without reference to the text. All abbreviations must be defined in footnotes. Footnote symbols: †, ‡, §, ¶, should be used (in that order) and *, **, *** should be reserved for P-values. Statistical measures such as standard deviation (SD) or standard error of the mean (SEM) should be identified in the headings.

Figure Legends/Captions

Each figure caption should have a brief title that describes the entire figure without citing specific panels, followed by a description of each panel. Captions should be concise but comprehensive—the figure and its caption must be understandable without reference to the text. Be sure to explain abbreviations in figures even if they have already been explained in-text. Axes for figures must be labeled with appropriate units of measurement and description. Include definitions of any symbols used and units of measurement.

2. Figures

Although authors are encouraged to send the highest quality figures possible, for peer-review purposes, a wide variety of formats, sizes, and resolutions are accepted. **Click here** for the basic figure requirements for figures submitted with manuscripts for initial peer review, as well as the more detailed post-acceptance figure requirements.

Helvetica typeface is preferred for lettering within figures. All letters, numbers and symbols must be at least 2 mm in height. Courier typeface should be used for sequence figures. Figures should be numbered consecutively with Arabic numerals, and they should be numbered in the order in which they appear in the text.

Figures should be submitted as electronic images to fit either one (55 mm, 2 3/16", 13 picas), two (115 mm, 4 1/2", 27 picas), or three (175 mm, 6 7/8", 41 picas) columns. The length of an illustration cannot exceed 227 mm (9"). Journal quality reproduction requires grey scale and color files at resolutions of 300 dpi. Bitmapped line art should be submitted at resolutions of 600–1200 dpi.

Figures submitted in color will be reproduced in color online free of charge. Authors wishing to have figures printed in color in hard copies of the journal will be charged a fee by the Publisher; further details are given **elsewhere** in these Author Guidelines. Authors should note however, that it is preferable that line figures (e.g., graphs) are supplied in black and white so that they are legible if printed by a reader in black and white.

Graphical Table of Contents

International Journal of Eating Disorders incorporates graphics and a small piece of text from journal articles into the online table of contents (which are distributed to readers who have signed up to Table of Contents (ToC) alerts). The extra graphic and text, in addition to being eye-catching, gives the reader a much more immediate impression of what each article will cover.

If you would like a graphic to accompany your article in the Table of Contents, please specify one of your figures. You will be given the option to specify a figure during the submission process at the file upload stage.

3. Supporting Information Files(s)

Supporting Information is information that is supplementary and not essential to the article, but provides greater depth and background. Examples of such information include more detailed descriptions of therapeutic protocols, results related to exploratory or post-hoc analyses, and elements otherwise not suitable for inclusion in the main article, such as video clips, large sections of tabular data, program code, or large graphical files. It is *not* appropriate to include, in the Supporting Information, text that would normally go into a discussion section; all discussion-related material should be presented in the main article.

Because the Supporting Information is separate from the paper and supplementary in nature, the main article should be able to be read as a stand-alone document by readers. Reference to the Supporting Information should be made in the text of the main article to provide context for the reader and highlight where and how the supplemental material contributes to the article.

Should authors wish to provide supplementary file(s) along with their article, these materials *must* be included upon submission to the journal. If such materials are added to the submission as a result of peer review, i.e., during a revision, then the authors should bring this to the attention of the editor in their response letter. If accepted for publication, Supporting Information is hosted online together with the article and appears without editing or typesetting.

Wiley's FAQs on Supporting Information are available on the Wiley Author Services site: **www.wileyauthors.com**.

Note: Authors are encouraged to utilize publicly available data repository for data, scripts, or other artefacts used to generate the analyses presented in the paper; in such cases, authors should include a reference to the location of the material within their paper.

General Style Points

The following points provide general advice on formatting and style.

- **Terminology**: The journal rejects terminology that refers to individuals by their condition. Terms such as "anorexics," "bulimics," "obese," or "diabetic," etc., as personal pronouns, referring to groups of individuals by their common diagnosis or condition, should be avoided. Terms like "individuals with anorexia nervosa," "people with bulimia nervosa," "participants with eating disorders," "patients with diabetes," or "participants with obesity," etc., should be used instead. Note, "participants" should be used in place of "subjects".
- **Abbreviations**: In general, terms should not be abbreviated unless they are used repeatedly and the abbreviation is helpful to the reader. Initially, use the word in full, followed by the abbreviation in parentheses. Thereafter use the abbreviation only.
- **Units of measurement**: Measurements should be given in SI or SI-derived units. Visit the Bureau International des Poids et Mesures (BIPM) website at www.bipm.fr for more information about SI units.
- **Numbers** under 10 should be spelt out, except for: measurements with a unit (8 mmol/L); age (6 weeks old), or lists with other numbers (11 dogs, 9 cats, 4 gerbils).
- **The word "data"** is plural; therefore, text should follow accordingly (for example, "The data show…the data are … the data were…").
- **Sex/Gender & Age**: When referring to sex/gender, "males" and "females" should be used only in cases where the study samples include both children (below age 18) and adults and only if word limit precludes using terms such as "male participants/female participants," "female patients/male patients"; when the participants comprise adults only, the terms "men" and "women" should be used. In articles that refer to children, "boys" and "girls" should be used.
- **Trade Names**: Chemical substances should be referred to by the generic name only. Trade names should not be used. Drugs should be referred to by their generic names. If proprietary drugs have been used in the study, refer to these by their generic name, mentioning the proprietary name and the name and location of the manufacturer in parentheses.

Wiley Author Resources

Manuscript Preparation Tips: Wiley has a range of resources for authors preparing manuscripts for submission available **here**. In particular, authors may benefit from referring to Wiley's best practice tips on **Writing for Search Engine Optimization**.

Article Preparation Support

Wiley Editing Services offers expert help with English Language Editing, as well as translation, manuscript formatting, figure illustration, figure formatting, and graphical abstract design – so you can submit your manuscript with confidence.

Also, check out our resources for **Preparing Your Article** for general guidance about writing and preparing your manuscript.

Return to Guideline Sections

5. EDITORIAL POLICIES AND ETHICAL CONSIDERATIONS

Editorial Review and Acceptance

Rigorous evaluation of submitted material by expert reviewers is essential to ensuring that the journal achieves its mission. To facilitate timely feedback to authors and to avoid burdening expert reviewers unduly, the journal utilizes a two-tiered review process for all contributions (whether invited or unsolicited). The first tier involves an initial editorial preview to be implemented within days of receipt of a submission. If the manuscript is considered to have potential for publication in the journal, the second tier involves peer review, typically by two to three experts. The Editor-in-Chief, at times, may delegate final decision making authority to one of the Associate Editors.

Editorial Pre-Screen. The Editor-in-Chief will pre-screen all submissions to determine the suitability based on fit with the journal's scope and scholarly merit. Manuscripts deemed to fall outside of the journal's scope or to be of limited merit (e.g., because of substantial methodological flaws or insufficiently novel contribution to the field) will not be sent out for peer review. Pre-screening of articles does not involve detailed evaluation. Authors receiving a negative decision at this stage may appeal by sending a concise rationale to the Editor-in-Chief.

Appeal of Rejection Decision. Requests for **appeal** will be considered only where the author makes a case that one or more reviewer, or the editor, has clearly made a substantive mistake. Submissions not sent out for external review are subject to the same grounds for appeal as submissions that have undergone full peer review. Please address appeal requests in writing to the Editor-in-Chief.

Peer Review. Submissions that, based on editorial pre-screening, are considered of potential suitability for the journal are forwarded to experts in the field—ad hoc reviewers or members of the journal's Editorial Board—for detailed evaluation and feedback. Expert reviewers are asked to evaluate the merit of a manuscript based on the quality of the methods applied, presentation, and overall contribution to the field. Reviewers are instructed to offer a

thorough, constructive, and timely evaluation of all aspects of the submission and to enumerate strengths and weaknesses. Authors are invited to recommend expert reviewers.

Wiley's policy on confidentiality of the review process is available here: **www.wileypeerreview.com/reviewpolicy**.

Revision Submission. Authors are asked to upload two versions of the revised manuscript. One version should include all tracked changes and be labelled "Manuscript with revisions" when uploaded. The other version should contain no mark up and be labelled "Manuscript" when uploaded.

Transferable Peer Review. To enable rapid publication of good quality research that is unable to be accepted for publication by the *International Journal of Eating Disorders*, we work together with Wiley's Open Access journals through **Wiley's Manuscript Transfer Program**: *Brain and Behavior*, *Obesity Science and Practice*, *Clinical Case Reports*, *and Molecular Genetics and Genomic Medicine*. Authors may be offered the option of having their manuscript (inc. any Supporting Information), along with any related peer reviews, automatically transferred for consideration by the Editor of the recieving journal. Authors taking up the offer to transfer will not need to reformat or rewrite their manuscript at that stage, and a publication decision will be made a short time after the transfer has taken place. The Editors of the recieving journals will accept submissions that report well-conducted research that reaches the standard acceptable for publication. These journals are a part of the Wiley Open Access portfolio (**www.wileyopenaccess.com**), and thus Article Publication Fees apply.

Work Involving Cross-Cultural Studies

If the work involves cross-cultural assessment or assessment in a new language or study population, authors should provide information about local literacy in the language of assessment, the validity of (or process for validating) a translation of an assessment, and for inclusion of regional samples, a statement about the representativeness of the regional sample (or distinction from) the national sample. If statistical analyses are employed, effect size estimates should be reported in the Results section.

Guidelines for Genetic Studies

Authors of manuscripts describing association studies should note that the *International Journal of Eating Disorders* has adopted Methods guidelines developed and published by the *American Journal of Medical Genetics Part B: Neuropsychiatric Genetics*. These guidelines recommend minimum sample sizes; in the case of positive findings, an adequately powered independent replication sample; and adjustments for multiple comparisons. As is required for all papers, the guidelines also require that authors report effect size estimates. For a complete description, please refer to the AJMGB Editorial Policy on Association Studies described in their **Author Guidelines**.

Please note, when referring to genetic material, the names of genes should be spelled out in full the first time they appear in the text, after which an italicized abbreviation can be substituted. Sequence variants should be described in the text and tables using both DNA and designations whenever appropriate. Sequence variant nomenclature must follow the current

Human Genome Variation Society (HGVS) guidelines; see **varnomen.hgvs.org**, where examples of acceptable nomenclature are provided.

Data Sharing and Data Accessibility

Please review Wiley's policy **here**. The *International Journal of Eating Disorders* expects but does not require data sharing.

All accepted manuscripts are required to publish a data availability statement to confirm the presence or absence of shared data.

The *International Journal of Eating Disorders* recognizes the many benefits of archiving research data. *IJED* expects you to archive all the data from which your published results are derived in a public repository. The repository that you choose should offer you guaranteed preservation (see the registry of research data repositories at **https://www.re3data.org/**) and should help you make it findable, accessible, interoperable, and re-useable, according to **FAIR Data Principles**.

The *International Journal of Eating Disorders* notes that FAIR data sharing allows for access to shared data under restrictions (e.g., to protect confidential or proprietary information) but notes that the FAIR principles encourage you to share data in ways that are as open as possible (but that can be as closed as necessary).

If you have shared data, this statement will describe how the data can be accessed, and include a persistent identifier (e.g., a DOI for the data, or an accession number) from the repository where you shared the data. If you cannot share the data described in your manuscript, for example for legal or ethical reasons, or do not intend to share the data then you must provide the appropriate data availability statement. Sample statements are available **here**. If published, all statements will be placed in the heading of your manuscript.

Human Studies and Subjects

For manuscripts reporting studies that involve human participants, a statement identifying the ethics committee that approved the study and confirmation that the study conforms to recognized standards is required, for example: **Declaration of Helsinki**; **US Federal Policy for the Protection of Human Subjects** ; or **European Medicines Agency Guidelines for Good Clinical Practice**.

Every effort should be taken to ensure the anonymity of the patient concerned, and any clinicians not involved as authors. If there is any potentially identifiable information, then it is the responsibility of the authors to seek and obtain approval from the local Institutional Review Board (IRB) (or equivalent) for the case to be reported, and a copy of that approval should be made available to the Editor on request.

Images and information from individual participants will only be published where the authors have obtained the individual's free prior informed consent. Authors do not need to provide a copy of the consent form to the publisher; however, in signing the author license to publish, authors are required to confirm that consent has been obtained. Wiley has a **standard patient consent form available** for use.

Animal Studies

A statement indicating that the protocol and procedures employed were ethically reviewed and approved, as well as the name of the body giving approval (e.g., in the USA, the Institutional Review Board (IRB) or Institutional Animal Care and Use Committee (IACUC)), must be included in the Methods section of the manuscript. Authors are encouraged to adhere to animal research reporting standards, for example the **ARRIVE reporting guidelines** for reporting study design and statistical analysis; experimental procedures; experimental animals and housing and husbandry. Authors should also state whether experiments were performed in accordance with relevant institutional and national guidelines for the care and use of laboratory animals:

- US authors should cite compliance with the US National Research Council's Guide for the Care and Use of Laboratory Animals, the US Public Health Service's Policy on Humane Care and Use of Laboratory Animals, and Guide for the Care and Use of Laboratory Animals.
- UK authors should conform to UK legislation under the Animals (Scientific Procedures) Act 1986 Amendment Regulations (SI 2012/3039).
- European authors outside the UK should conform to Directive 2010/63/EU.

Clinical Trial Registration

The journal requires that clinical trials are prospectively registered in a publicly accessible database and clinical trial registration numbers are included in all papers that report their results. The name of the trial register and the clinical trial registration number should appear at the end of the abstract along with the URL for a hyperlink, if possible. A full list of registers can be found via the **WHO International Clinical Trials Registry Platform (ICTRP)**. Contributors should make clear when registration took place relative to the start or end of data gathering. Any discrepancies between the trial protocol and the study itself must be reported and justified in the methods section of the submitted paper. If the trial is not registered, or was registered retrospectively, the reasons for this should be explained.

Research Reporting Guidelines

Accurate and complete reporting enables readers to fully appraise research, replicate it, and use it. Authors are encouraged to adhere to any research reporting standards relevant to their study. A list of the most well-known guidelines is given here:

- Consolidated Standards of Reporting Trials (CONSORT)
- Standard Protocol Items: Recommendations for Interventional Trials (SPIRIT)
- Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)
- PRISMA Protocols (PRISMA-P)
- STrengthening the Reporting of OBservational studies in Epidemiology (STROBE)
- CARE: Guidelines to increase the accuracy, transparency, and usefulness of case reports
- Consolidated criteria for reporting qualitative research (COREQ) by Tong et al. (*Int. J. Qual. Health Care* (**2007**) *19*(6): 349–357)

- STARD 2015: An Updated List of Essential Items for Reporting Diagnostic Accuracy Studies
- TRIPOD: Transparent Reporting of a multivariable prediction model for Individual Prognosis Or Diagnosis
- Consolidated Health Economic Evaluation Reporting Standards (CHEERS) by Husereau et al. (*BMC Medicine*(**2013**) *11*: 80; DOI: 10.1186/1741-7015-11-80)
- The EQUATOR Network: an author's one-stop-shop for writing and publishing high-impact health research
- FORCE11: Recommended reporting guidelines for life science resources
- ARRIVE (Animal Research: Reporting of In Vivo Experiments) guidelines
- Guidance for the Description of Animal Research in Scientific Publications from the US National Research Council's Institute for Laboratory Animal Research
- The Gold Standard Publication Checklist from Hooijmans et al. (ATLA (**2010**) *38*: 167–182)

Species Names

Upon its first use in the title, abstract, and text, the common name of a species should be followed by the scientific name (genus, species, and authority) in parentheses. For well-known species, however, scientific names may be omitted from article titles. If no common name exists in English, only the scientific name should be used.

Sequence Data

Nucleotide sequence data can be submitted in electronic form to any of the three major collaborative databases: DDBJ, EMBL, or GenBank. It is only necessary to submit to one database as data are exchanged between DDBJ, EMBL, and GenBank on a daily basis. The suggested wording for referring to accession-number information is: 'These sequence data have been submitted to the DDBJ/EMBL/GenBank databases under accession number U12345'. Addresses are as follows:

- DNA Data Bank of Japan (DDBJ): www.ddbj.nig.ac.jp
- EMBL Nucleotide Archive: ebi.ac.uk/ena
- GenBank: www.ncbi.nlm.nih.gov/genbank

Proteins sequence datashould be submitted to either of the following repositories.

- RCSB Protein Data Bank (PDB): www.rcsb.org/pdb.
- Protein Information Resource (PIR): pir.georgetown.edu
- SWISS-PROT: expasy.ch/sprot/sprot-top

Conflict of Interest

The journal requires that all authors disclose any potential sources of conflict of interest. Any interest or relationship, financial or otherwise that might be perceived as influencing an

author's objectivity is considered a potential source of conflict of interest. These must be disclosed when directly relevant or directly related to the work that the authors describe in their manuscript.

Potential sources of conflict of interest include, but are not limited to: employment at a for-profit treatment center where data collection occurred, employment at a for-profit corporation if the corporation manufactures or sells products used in the research (e.g., medications; equipment used in a treatment tested as part of the research), patent or stock ownership, membership of a company board of directors, membership of an advisory board or committee for a company, and consultancy for or receipt of speaker's fees from a company.

The existence of a conflict of interest does not preclude publication. It is the responsibility of the corresponding author to review this policy with all authors and collectively to disclose with the submission ALL pertinent commercial and other relationships. These conflicts of interest should be disclosed in the relevant section of the submission questionnaire and in the manuscript. If the authors have no conflict(s) of interest to declare, they must also state this.

Funding

Authors should list all funding sources in the Acknowledgments section. Authors are responsible for the accuracy of their funder designation. If in doubt, please check the Open Funder Registry for the correct nomenclature: **www.crossref.org/services/funder-registry**.

Authorship

The list of authors should accurately illustrate who contributed to the work and how. All those listed as authors should qualify for authorship according to the following criteria:

1. Have made substantial contributions to conception and design, or acquisition of data, or analysis and interpretation of data;
2. Been involved in drafting the manuscript or revising it critically for important intellectual content;
3. Given final approval of the version to be published. Each author should have participated sufficiently in the work to take public responsibility for appropriate portions of the content; and
4. Agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Contributions from anyone who does not meet the criteria for authorship should be listed, with permission from the contributor, in an Acknowledgments section (for example, to recognize contributions from people who provided technical help, collation of data, writing assistance, acquisition of funding, or a department chairperson who provided general support). Prior to submitting the article all authors should agree on the order in which their names will be listed in the manuscript.

Joint first or senior authorship: In the case of joint first authorship, a footnote should be added to the author listing, e.g. ‘X and Y should be considered joint first author’ or ‘X and Y should be considered joint senior author.’

Authorship responsibilities: Eligibility for authorship requires that authors have made substantive contributions to the work described in the manuscript, have read and approved the manuscript in its current form, and have approved the ordering of authorship. All authors agree that, once a manuscript has been submitted, the subsequent addition, removal or change of authorship order requires the approval of all authors (including making such changes as part of a resubmission). Such changes in revised versions of a manuscript should be brought to the attention of the Editor in the response letter.

Wiley's Author Name Change Policy: In cases where authors wish to change their name following publication, Wiley will update and republish the paper and redeliver the updated metadata to indexing services. Our editorial and production teams will use discretion in recognizing that name changes may be of a sensitive and private nature for various reasons including (but not limited to) alignment with gender identity, or as a result of marriage, divorce, or religious conversion. Accordingly, to protect the author's privacy, we will not publish a correction notice to the paper, and we will not notify co-authors of the change. Authors should contact the journal's Editorial Office with their name change request.

ORCID

As part of the journal's commitment to supporting authors at every step of the publishing process, the journal requires the submitting author (only) to provide an ORCID iD when submitting a manuscript. If the submitting author is not already registered with ORCID, they can do so here: **orcid.org/register**; this takes around 2 minutes to complete. For more information, visit **www.wileyauthors.com/orcid**.

Publication Ethics

The *International Journal of Eating Disorders* is a member of the **Committee on Publication Ethics (COPE)**. Note this journal uses iThenticate's CrossCheck software to detect instances of overlapping and similar text in submitted manuscripts. Read the *Top 10 Publishing Ethics Tips for Authors* at **www.wileyauthors.com/ethics** ; a link to **Wiley's Publication Ethics Guidelines** can also be found there.

Return to the Guideline Sections

6. AUTHOR LICENSING

If a paper is accepted for publication, the author identified as the formal corresponding author will receive an email prompting them to log in to Author Services, where via the Wiley Author Licensing Service (WALS) they will be required to complete a copyright license agreement on behalf of all authors of the paper.

Authors may choose to publish under the terms of the journal's standard copyright agreement, or **OnlineOpen** under the terms of a Creative Commons (CC) License.

General information regarding licensing and copyright is available **here**. To review the Creative Commons License options offered under OnlineOpen, please **click here**. (Note that certain funders mandate that a particular type of CC license has to be used; the Wiley Author Compliance Tool, available at **www.wileyauthors.com/compliancetool**, provides assistance to authors in checking for any open-access mandates from their funder(s).)

Self-Archiving Definitions and Policies

Note that the journal's standard copyright agreement allows for self-archiving of different versions of the article under specific conditions. For more detailed information about self-archiving definitions and policies, visit **www.wileyauthors.com/self-archiving**.

Open Access Fees

Authors choosing to publish using OnlineOpen will be charged a fee. A list of Article Publication Charges for Wiley journals is available at **www.wileyauthors.com/APCpricing**.

Funder Open Access

For more information on Wiley's compliance with the open-access policies of specific funders, visit **www.wileyauthors.com/funderagreements**.

Return to Guideline Sections

7. PUBLICATION PROCESS AFTER ACCEPTANCE

Accepted Articles Received in Production

Signing the License

When an accepted article is received by Wiley's production team, the corresponding author will receive an email asking them to login or register with **Wiley Author Services** . The author will be asked to sign a publication license at this point. Further details are given in **Section 6** of these Author Guidelines.

Proofs

Once the paper is typeset, the author will receive an email notification with the URL to download a PDF typeset page proof, as well as associated forms and full instructions on how to correct and return the file.

Please note that the author is responsible for all statements made in their work, including changes made during the editorial process—authors should check proofs carefully. Note that proofs should be returned within 48 hours from receipt.

Questions regarding the production of articles accepted for publication in the *International Journal of Eating Disorders* should be directed to the Production Editor: **eat@wiley.com**

Publication Charges

There are **no mandatory charges** to authors publishing in the *International Journal of Eating Disorders*.

Authors may choose to publish in an open access format through OnlineOpen, which carries a fee (see the section on Author Licensing).

Color figures may be published online free of charge; however, the journal charges for publishing figures in color in print. If the author supplies color figures at Early View publication, they will be invited to complete a color charge agreement in RightsLink for Author Services. The author will have the option of paying immediately with a credit or debit

card, or they can request an invoice. If the author chooses not to purchase color printing, the figures will be converted to black and white for the print issue of the journal.

Early View

The journal offers rapid publication via Wiley's Early View service. **Early View** (online Version of Record) articles are published on Wiley Online Library before inclusion in an issue. Note there may be a delay after corrections are received before the article appears online, as the proofs need to be reviewed and processed. Once the article is published on Early View, no further changes are possible. The Early View article is fully citable and carries an online publication date and Digital Object Identifier (DOI) for citations.

Video Abstracts

A video abstract can be a quick way to make the message of your research accessible to a much larger audience. Wiley and its partner Research Square offer a service of professionally produced video abstracts, available to authors of articles accepted in this journal. You can learn more about it at **www.wileyauthors.com/videoabstracts**. If you have any questions, please direct them to **videoabstracts@wiley.com**.

Return to Guideline Sections

8. POST PUBLICATION

Access and Sharing

When the article is published online:

- The author receives an email alert (if requested).
- The link to the published article can be shared through social media.
- The author will have free access to the paper (after accepting the Terms & Conditions of use, they can view the article).
- The corresponding author and co-authors can nominate up to ten colleagues to receive a publication alert and free online access to the article.

Authors may order print copies of the article. Instructions are sent at proofing stage. Alternatively, authors may use the following link: **caesar.sheridan.com/reprints/redir.php?pub=10089&acro=eat** or email **chris.jones@sheridan.com**.

Promoting an Article

Wiley's Promotional Toolkit is a resource designed to help authors disseminate their work to the fullest extent through their networks and beyond. Authors can find the toolkit and other ideas on how to promote their research here: **www.wileyauthors.com/maximize**.

Wiley Editing Services offers professional video, design, and writing services to create shareable video abstracts, infographics, conference posters, lay summaries, and research news stories for your research – so you can help your research get the attention it deserves.

Cover Image Submissions

This journal accepts artwork submissions for Cover Images. This is an optional service you can use to help increase article exposure and showcase your research. For more information, including artwork guidelines, pricing, and submission details, please visit the **Journal Cover Image page.**

Authors intending to issue a press release through their institution or affiliation are kindly asked to inform the Editorial Office at their earliest convenience.

Measuring the Impact of an Article

Wiley also helps our authors **measure the impact** of their research through citation tracking, and specialist partnerships with Kudos (**www.wileyauthors.com/ kudos**) and Altmetric (**www.wileyauthors.com/altmetric**).

Return to Guideline Sections

9. JOURNAL CONTACT DETAILS

Author queries regarding submissions under review or accepted articles in production should be directed to the Editorial Office (**ijed@wiley.com**) or Production Editor (**IJEDprod@wiley.com**), respectively.

Author Guidelines updated May 31, 2019

Appendix 22: Eating Disorders: The Journal of Treatment & Prevention Author Guidelines

About the Journal

Eating Disorders is an international, peer-reviewed journal publishing high-quality, original research. Please see the journal's Aims & Scope for information about its focus and peer-review policy.

Please note that this journal only publishes manuscripts in English.

Eating Disorders accepts the following types of article: Research Articles, Brief Reports, Last Word, How I Practice.

Manuscript submissions must be substantive and of exceptional reach in terms of challenging or potentiating the field of eating disorder prevention and treatment forward in the areas of research and/or practice.

Articles for EDJTP are generally unsolicited. However, for special topical issues or needs established by the Editors-in-Chief, manuscripts may be solicited from authors with expertise appropriate to the special topic or need. Accordingly, in some cases, anonymous and/or masked peer-review is not possible. If you'd like to propose a special issue, please contact the Editors-in-Chief Leslie Karwoski Anderson (leslie.karwoski.anderson@gmail.com) and Catherine Cook-Cottone (catherine.cook.cottone@gmail.com) for guidelines. Social Media Part of the mission of EDJTP is to disseminate cutting edge research on eating disorders to clinicians, academics, advocates, and sufferers. Thus, we have a social media editor, and we make it a priority to publicize articles through social media outlets. Authors can help generate publicity for their own articles by posting articles, or sharing EDJTP 's posts. (Find us on Twitter @EDsJTP and Facebook.)

Open Access

You have the option to publish open access in this journal via our Open Select publishing program. Publishing open access means that your article will be free to access online immediately on publication, increasing the visibility, readership and impact of your research. Articles published Open Select with Taylor & Francis typically receive 32% more citations* and over 6 times as many downloads** compared to those that are not published Open Select.

Your research funder or your institution may require you to publish your article open access. Visit our Author Services website to find out more about open access policies and how you can comply with these.

You will be asked to pay an article publishing charge (APC) to make your article open access and this cost can often be covered by your institution or funder. Use our APC finder to view the APC for this journal.

Please visit our Author Services website or contact openaccess@tandf.co.uk if you would like more information about our Open Select Program.

*Citations received up to Jan 31st 2020 for articles published in 2015-2019 in journals listed in Web of Science®.
**Usage in 2017-2019 for articles published in 2015-2019.

Peer Review and Ethics

Taylor & Francis is committed to peer-review integrity and upholding the highest standards of review. Once your paper has been assessed for suitability by the editor, it will then be double blind peer reviewed by independent, anonymous expert referees. Find out more about what to expect during peer review and read our guidance on publishing ethics.

Preparing Your Paper

Structure

Your paper should be compiled in the following order: title page; abstract; keywords; main text introduction, materials and methods, results, discussion; acknowledgments; declaration of interest statement; references; appendices (as appropriate); table(s) with caption(s) (on individual pages); figures; figure captions (as a list).

Word Limits

Please include a word count for your paper. Word limits for this journal vary by article type. Please refer to the Style Guidelines section for a complete listing of word limits.

Style Guidelines

Please refer to these quick style guidelines when preparing your paper, rather than any published articles or a sample copy.

Any spelling style is acceptable so long as it is consistent within the manuscript.

Any form of consistent quotation style is acceptable. Please note that long quotations should be indented without quotation marks.

We publish four types of articles:1) Research Articles, 2) Brief Reports, 3) Last Word, 4) How I Practice.

1) Research Articles

These contributions report substantive research that is novel, definitive, or complex enough to require a longer communication.

•Word Limit: 6000 (including abstract, references, tables or figures)

•Abstract: 200 words.

When preparing their manuscript, authors should follow the IMRaD guidelines (Introduction, Methods, Results, and Discussion), which are recommended by the International Committee of Medical Journal Editors (ICMJE) (J. Pharmacol. Pharmacother. 2010, 1, 42–58). When preparing the Methods section, authors should refer to the Editorial Policy on Sample Size and Statistics.

2) Brief Reports.

This contribution type is intended for manuscripts describing studies with straightforward research designs, pilot or “proof of concept” studies, and replications.

•Word Limit: 2,500 (including abstract, references, tables or figures).

•Abstract: 150 words.

When preparing brief reports, authors should follow the IMRaD guidelines and comply with the Editorial Policy on Sample Size and Statistics.

3) Last Word

This contribution type is intended for manuscripts written in a more editorial tone, generally first person, addressing innovation or debate in the field. Last Word articles should be theoretical, practice, or policy pieces that integrate recent and rigorous research.

•Word Limit: 1000-3000 (including abstract, references, tables or figures).

•Abstract: 150 words.

4) How I Practice

How I Practice pieces are written in the first person, and are intended to explore a specific area of treatment, practice technique, or treatment strategy. These are not intended to be case studies.

•Word Limit: 1000-3000 (including abstract, references, tables or figures).

•Abstract: 150 words.

Formatting and Templates

Papers may be submitted in Word format. Figures should be saved separately from the text. To assist you in preparing your paper, we provide formatting template(s).

Word templates are available for this journal. Please save the template to your hard drive, ready for use.

If you are not able to use the template via the links (or if you have any other template queries) please contact us here.

The journal’s peer-review process follows the journal program guidelines of the American Psychological Association (APA), Publication Manual, 7th Edition. As this manual is updated, Eating Disorders will adjust its processes to accommodate alterations made to this manual. The APA website include a range of resources, such as An overview of the Publication Manual of the American Psychological Association, Sixth Edition; and free tutorials on APA Style basics and an APA Style Blog.

Note, manuscripts submitted that are not in APA style will not be sent to reviewers and will be returned to the authors. All submissions will be screened using duplication software. All

manuscripts with scores higher than 12% will be returned to the authors for editing to reduce replicated material.

The text should be presented in the following order:

I.Title Page

i.The full names of all authors
ii. The authors' institutional affiliations where the work was conducted, with a footnote for an author's present address if different to where the work was carried out
iii.Acknowledgements

II.Abstract and Keywords

The abstract should be running text without subheadings.
Please provide five to seven keywords. Keywords should be taken from those recommended by the US National Library of Medicine's Medical Subject Headings (MeSH) browser list at www.nlm.nih.gov/mesh

III.Clinical Implications

Clinical Implications are required for each article, in keeping with our journal's mission of publishing research that is clinically applicable and practical. They consist of a short list of bullet points that convey the core findings and clinical implications of the article and should be submitted under the abstract in the online submission system. Please use 'Clinical Implications' in the file name and include 3 to 5 bullet points (maximum 85 characters, including spaces, per bullet point).

IV.Blinded Manuscript

i.Title
ii.Main text: double-spaced, with numbered manuscript pages

V.References

References in all manuscripts should follow the style of the American Psychological Association (7th edition). Please note APA referencing style requires that a Digital Object Identifier (DOI) be provided for all references where available.

VI.Tables, Figures, and Supplemental Material

Each table and figure should have a title and footnotes. Tables and figures should not be embedded in the text, but should be included as separate sheets or files. A short descriptive title should appear above each table with a clear legend and any footnotes suitably identified below. All units must be included. Figures should be completely labeled, taking into account necessary size reduction. Captions should be typed, double-spaced, on a separate sheet.

References

Please use this reference guide when preparing your paper.

Taylor & Francis Editing Services

To help you improve your manuscript and prepare it for submission, Taylor & Francis provides a range of editing services. Choose from options such as English Language Editing, which will ensure that your article is free of spelling and grammar errors, Translation, and Artwork Preparation. For more information, including pricing, visit this website.

Checklist: What to Include

Author details. All authors of a manuscript should include their full name and affiliation on the cover page of the manuscript. Where available, please also include ORCiDs and social media handles (Facebook, Twitter or LinkedIn). One author will need to be identified as the corresponding author, with their email address normally displayed in the article PDF (depending on the journal) and the online article. Authors' affiliations are the affiliations where the research was conducted. If any of the named co-authors moves affiliation during the peer-review process, the new affiliation can be given as a footnote. Please note that no changes to affiliation can be made after your paper is accepted. Read more on authorship.

Should contain an unstructured abstract of 200 words.

You can opt to include a video abstract with your article. Find out how these can help your work reach a wider audience, and what to think about when filming.

Read making your article more discoverable, including information on choosing a title and search engine optimization.

Funding details. Please supply all details required by your funding and grant-awarding bodies This work was supported by the [Funding Agency #1] under Grant [number xxxx]; [Funding Agency #2] under Grant [number xxxx]; and [Funding Agency #3] under Grant [number xxxx].

Disclosure statement. This is to acknowledge any financial interest or benefit that has arisen from the direct applications of your research. Further guidance on what is a conflict of interest and how to disclose it.

Data availability statement. If there is a data set associated with the paper, please provide information about where the data supporting the results or analyses presented in the paper can be found. Where applicable, this should include the hyperlink, DOI or other persistent identifier associated with the data set(s). Templates are also available to support authors.

Data deposition. If you choose to share or make the data underlying the study open, please deposit your data in a recognized data repository prior to or at the time of submission. You will be asked to provide the DOI, pre-reserved DOI, or other persistent identifier for the data set.

Supplemental online material. Supplemental material can be a video, dataset, fileset, sound file or anything which supports (and is pertinent to) your paper. We publish supplemental material online via Figshare. Find out more about supplemental material and how to submit it with your article.

Figures. Figures should be high quality (1200 dpi for line art, 600 dpi for grayscale and 300 dpi for color, at the correct size). Figures should be supplied in one of our preferred file formats: EPS, PDF, PS, JPEG, TIFF, or Microsoft Word (DOC or DOCX) files are acceptable for

figures that have been drawn in Word. For information relating to other file types, please consult our Submission of electronic artwork document.

Tables. Tables should present new information rather than duplicating what is in the text. Readers should be able to interpret the table without reference to the text. Please supply editable files.

Equations. If you are submitting your manuscript as a Word document, please ensure that equations are editable. More information about mathematical symbols and equations.

Units. Please use SI units (non-italicized).

Using Third-Party Material in your Paper

You must obtain the necessary permission to reuse third-party material in your article. The use of short extracts of text and some other types of material is usually permitted, on a limited basis, for the purposes of criticism and review without securing formal permission. If you wish to include any material in your paper for which you do not hold copyright, and which is not covered by this informal agreement, you will need to obtain written permission from the copyright owner prior to submission. More information on requesting permission to reproduce work(s) under copyright.

Submitting Your Paper

This journal uses Editorial Manager to manage the peer-review process. If you haven't submitted a paper to this journal before, you will need to create an account in Editorial Manager. Please read the guidelines above and then submit your paper in the relevant Author Center, where you will find user guides and a helpdesk.

Please note that *Eating Disorders* uses Crossref™ to screen papers for unoriginal material. By submitting your paper to *Eating Disorders* you are agreeing to originality checks during the peer-review and production processes.

On acceptance, we recommend that you keep a copy of your Accepted Manuscript. Find out more about sharing your work.

Data Sharing Policy

This journal applies the Taylor & Francis Basic Data Sharing Policy. Authors are encouraged to share or make open the data supporting the results or analyses presented in their paper where this does not violate the protection of human subjects or other valid privacy or security concerns.

Authors are encouraged to deposit the dataset(s) in a recognized data repository that can mint a persistent digital identifier, preferably a digital object identifier (DOI) and recognizes a long-term preservation plan. If you are uncertain about where to deposit your data, please see this information regarding repositories.

Authors are further encouraged to cite any data sets referenced in the article and provide a Data Availability Statement.

At the point of submission, you will be asked if there is a data set associated with the paper. If you reply yes, you will be asked to provide the DOI, pre-registered DOI, hyperlink, or other persistent identifier associated with the data set(s). If you have selected to provide a pre-registered DOI, please be prepared to share the reviewer URL associated with your data deposit, upon request by reviewers.

Where one or multiple data sets are associated with a manuscript, these are not formally peer reviewed as a part of the journal submission process. It is the author's responsibility to ensure the soundness of data. Any errors in the data rest solely with the producers of the data set(s).

Publication Charges

There are no submission fees, publication fees or page charges for this journal.

Color figures will be reproduced in color in your online article free of charge. If it is necessary for the figures to be reproduced in color in the print version, a charge will apply.

Charges for color figures in print are $400 per figure (£300; $500 Australian Dollars; €350). For more than 4 color figures, figures 5 and above will be charged at $75 per figure (£50; $100 Australian Dollars; €65). Depending on your location, these charges may be subject to local taxes.

Copyright Options

Copyright allows you to protect your original material, and stop others from using your work without your permission. Taylor & Francis offers a number of different license and reuse options, including Creative Commons licenses when publishing open access. Read more on publishing agreements.

Complying with Funding Agencies

We will deposit all National Institutes of Health or Wellcome Trust-funded papers into PubMedCentral on behalf of authors, meeting the requirements of their respective open access policies. If this applies to you, please tell our production team when you receive your article proofs, so we can do this for you. Check funders' open access policy mandates here. Find out more about sharing your work.

My Authored Works

On publication, you will be able to view, download and check your article's metrics (downloads, citations and Altmetric data) via My Authored Works on Taylor & Francis Online. This is where you can access every article you have published with us, as well as your free eprints link, so you can quickly and easily share your work with friends and colleagues.

We are committed to promoting and increasing the visibility of your article. Here are some tips and ideas on how you can work with us to promote your research.

Article Reprints

You will be sent a link to order article reprints via your account in our production system. For enquiries about reprints, please contact Taylor & Francis at reprints@taylorandfrancis.com. You can also order print copies of the journal issue in which your article appears.

Queries

Should you have any queries, please visit our Author Services website or contact us here.

Updated 30-04-2020

Appendix 23: Ethical Approval

UCC
University College Cork, Ireland
Coláiste na hOllscoile Corcaigh

Coláiste na nEalaíon, an Léinn Cheiltigh agus na nEolaíochtaí Sóisialta
College of Arts, Celtic Studies and Social Sciences

Scoil an Síceolaíochta Feidhmí
School of Applied Psychology

University College Cork,
Cork, Ireland.

T +353 (0)21 490 4551 / 4552
E infoapsych@ucc.ie
http://www.ucc.ie/en/apsych/

12th November 2020

Clinical Psychology Research and Ethics

Dear Shane,

An evaluation of the social and emotional cognition of young people with anorexia nervosa

Shane Mulligan

Thank you for your ethics application and subsequent amendments. Your application has been approved by the Clinical Psychology Research and Ethics Committee and you have full ethical approval for the above named project.

Yours sincerely,
Dr Mike Murphy

Chair Clinical Psychology Research and Ethics Panel

Prof Carol Linehan
Head of School of Applied Psychology

Coláiste na hOllscoile Corcaigh
University College Cork