An examination of the clinical outcomes of adolescents and young adults with broad autism spectrum traits and autism spectrum disorder and anorexia nervosa: a multi centre study.

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Abstract

Objectives

To compare the clinical outcomes of adolescents and young adults with anorexia nervosa (AN) co-morbid with broad autism spectrum disorder (ASD) or ASD traits.

Method

The Developmental and Well-Being Assessment (DAWBA) and Social Aptitude Scale (SAS) were used to categorise adolescents and young adults with AN (N=149) into those with ASD traits (N=23), and those who also fulfilled diagnostic criteria for a possible/probable ASD (N=6). We compared both eating disorders specific measures and broader outcome measures at intake and twelve months follow-up.

Results

Those with ASD traits had significantly more inpatient/day-patient service use (p= .015), as well as medication use (p<.001) at baseline. Both groups All patients had high social difficulties and poorer global functioning (SDQ) at baseline , which improved over time but remained higher at 12 months in the ASD traits group (p= .002). However, the improvement in eating disorder symptoms at 12 months was similar between groups with or without ASD traits. Treatment completion rates between AN only and ASD traits were similar (80.1 vs. 86.5%).

Conclusion

Adolescents with AN and ASD traits show similar reductions in their eating disorder symptoms. Nevertheless, their social difficulties remain high suggesting that these are life-long difficulties rather than starvation effects.

Introduction

Neurodevelopmental disorders have been associated with Eating Disorders (ED), with Attention-Deficit / Hyperactivity Disorder linked to Bulimia Nervosa (BN) and Binge Eating Disorder (BED) (Nazar et al., 2016), and Autism Spectrum Disorders (ASD) to Anorexia Nervosa (AN) (Baron-Cohen et al., 2013; Tchanturia et al., 2013). There has been interest in the impact these might have upon treatment and prognosis (Westwood & Tchanturia, 2017).

In a Swedish cohort of AN adolescents, 32% had ASD traits at some time over the course of 18 years follow-up and this sub-group had a poorer long term prognosis (Anckarsäter et al., 2012), with particular problems in mental and social functioning (Nielsen et al., 2015). In a series of AN cases referred to a specialized child and adolescent service, 6.9% had broad ASD traits (using the Autism-Spectrum Quotient [AQ]) and this sub-group were more likely to progress to more intensive levels of care (day or inpatient) (Stewart, McEwen, Konstantellou, Eisler, & Simic, 2017). In line with these findings, we have previously reported that 19% of AN adolescents presenting for treatment had ASD traits with 4% receiving a probable/possible ASD diagnosis (Rhind et al., 2014). These findings suggest that people with AN and associated ASD traits may have a less favorable prognosis.

We therefore aimed to examine the 12 months outcomes of patients who had ASD traits and those with a probable/possible ASD diagnosis in a sample of individuals with AN participating in a randomized controlled trial.

Method

The present report is a secondary data analysis from the Experienced Carers Helping Others (ECHO) trial. This trial aimed to assess the benefits of a carer intervention added to usual treatment, where they received materials and telephone coaching to better cope with their offspring's ED.

Participants were aged between 13-21 and consisted of 149 adolescents with AN or Atypical AN, among which, 15.4% had ASD traits and 4% received a possible/probable ASD diagnosis. Some baseline features have been described previously (Rhind et al., 2014) as well as details regarding the original trial (Hibbs et al., 2015).

Assessment Measures

Details regarding measures can be found in the Supplementary materials and are summarised below:

The Developmental and Well-being Assessment (DAWBA) (Goodman, Ford, Richards, Gatward, & Meltzer, 2000). Both parent and patients completed the ED and ASD modules for this computerized diagnostic instrument and trained psychiatrists confirmed the psychiatric diagnosis afterwards (DSM-IV (American Psychiatric Association, 2000) and ICD-10 (World Health Organization, 1993).

Strengths and Difficulties Questionnaire (SDQ) (Goodman & Scott, 1999). An instrument with five sub-scales (peer problems, prosocial difficulties, hyperactivity, emotional problems, and conduct problems), completed both by parent and patients at baseline and 12 months.

Social Aptitude Scale (SAS)(Liddle, Batty, & Goodman, 2009). Parents report retrospectively on their child's social development comparing their child's abilities to those of their peers, completed at baseline only.

The Short Evaluation of Eating Disorders (SEED) (Bauer, Winn, Schmidt, & Kordy, 2005). A 6-item measure of ED symptom severity. The outcomes include a three items severity score for AN (ANTSI) and three items for BN (BNTSI). The score from each item can range from 0 to 3 (0 = symptom not present; 3 = symptom is extreme).

The Depression, Stress and Anxiety Scale (DASS-21) (Henry & Crawford, 2005). A shortened version of the DASS with good internal consistency on each of the sub-scales.

Statistical Analyses

Statistical analyses were completed using IBM SPSS Statistics Version 22. The sample was divided into two sub-groups (mutually exclusive) based on scores on the SAS using standard cut off criteria (Liddle, Batty, & Goodman, 2009): (1) AN only (SAS above 16) (n=126); (2) broad ASD traits (n=23). Among the latter group, six individuals formed the ASD diagnosis subset which was also compared to AN only.

As the group with broad ASD traits is small, we report Cohen's d effect sizes to indicate the magnitude of differences between groups. Cohen's effect sizes are understood as negligible (<0.15), small ($0.15 \leq d < 0.40$), medium ($0.40 \leq d < 0.75$), large ($0.75 \leq d$).

Mann-Whitney U tests compared differences between sub-groups where the data was non-parametrically distributed. Chi-square tests were performed for comparing proportions and Spearman correlations for non-parametric associations.

Results

The baseline sociodemographic characteristics are presented in **Table 1** and the clinical characteristics are presented in **Table 2**. Regarding ECHO treatment allocation, there were no significant differences between AN only and broad ASD traits groups (X^2 =.077 ; p = .782). Participants with broad ASD traits had had more general inpatient and day-patient days (U= 1077.0, z = 2.433, p = .015) and had been more frequently admitted to an ED specialist inpatient treatment (18.2% *vs* 5%; (X^2 =6.62 ; p = .02). Furthermore, the ASD group presented with more antipsychotic use (X^2=11.74; p< .001) prior to presentation. Baseline SAS scores were significantly and inversely correlated with baseline antipsychotic use in the total sample (rho= - .21; p= .017). At baseline, ED symptoms were similar between groups but the group with broad ASD traits had higher parental (p<.0001) and self-reported (U= 795.5, z= -2.16, p= .03) total general difficulties on the SDQ.

There was no significant difference (X^2 = .588; p= .44) between the proportion of participants who completed the 12 month follow-up in the AN only (80.1%) and the broad ASD traits group (86.95%). Both groups had similar increases in BMI and *weight for height* from baseline to 12 months, as well as similar reductions in ED symptoms. After 12 months, there were no differences between the groups in medication use (X^2= 2.44; p= .111) (**Table 1**).

Both groups had decreases in general difficulties (SDQ) over time. However, those in the ASD group continued to have a higher level of total general difficulties (SDQ) at 12 month (U= 49.0, z= -3.10, p= .002). Parents, in general, reported higher levels of problems than the patients themselves but there was convergence between parent (U= 485.0, z= -3.23, p= .0001) and patient reports (U= 280.0, z= -3.68, p < .0001). Significantly higher general difficulties (SDQ) among those in the ASD traits group were found for both parent (U=

497.0, z= 4.24, p< .0001) and self-report (U= 795.5, z= -2.16, p= .03), and for the subscale peer difficulties (SDQ), both on parent (U= 422.0, z= -4.56, p< .0001) and self-report (U= 629.5, z= -3.25, p< .0001). SDQ results are presented in **Table 3** for AN only versus Broad ASD traits group, and SDQ data from the ASD subset is presented in a different version of this table on the **Supplementary materials**.

The 'ASD probable /possible diagnosis' subgroup

The social difficulties of the six participants (five possible, one definite) with an ASD diagnosis improved over time (d= 2.02; p= .03) but, as expected, remained higher than in the other group of patients. Other domains of difficulties also improved (**Table 2**).

We obtained an update on the clinical functioning of these six possible cases at two-years post intake. Four of them had continued in treatment; one had persistent AN and low weight (BMI = 15.7 kg/m^2); another transitioned to Bulimia Nervosa and eventually reached a BMI of $25kg/m^2$. One patient experienced continuing social and mood problems and another severe OCD. The remaining two were not in treatment and were presumed to be well.

Discussion

The aim of this study was to examine the clinical course of young people with AN who also had ASD traits (broad and narrow/diagnostic). The ASD traits group had a greater use of intensive treatment (in/day-patient) and medication use before presentation to the specialist clinic and more general difficulties (SDQ), both at baseline and after receiving specialist treatment. However, eating disorder symptoms (BMI, *weight for height* and SEED) in the broad and narrow/diagnostic groups did not differ from the comparison group both at

baseline and at 12 months. The majority of the narrow/diagnostic group continued to have contact with mental health services two years after presentation, two of whom had a persistent eating disorder. A poorer prognosis in the ASD group appears to relate to the more severe general comorbidity than to the eating disorder outcomes alone.

The 15.4% (23/149) prevalence of SAS scores below cut-off (ASD traits group) in this sample is the same as that found in a clinical cohort of AN and EDNOS cases (Stewart et al., 2017). However, the computer generated probability of ASD diagnosis from the DAWBA in the clinical cohort (Stewart et al., 2017) did not differ from community norms, whilst in our sample, a trained psychiatrist reviewed the DAWBA and we found one probable and five possible cases (Rhind et al., 2014). There were differences in the clinical specifiers between these studies., . The clinical cohort (Stewart et al., 2017) included people with an age range of 9-18 (mean=14.6), whereas the current study included people from age 13-21 years (mean=17). Previous studies suggest that the prevalence of ASD traits varies according to the age/duration of illness of the sample included. For example, in a recent meta-analysis lower levels of ASD traits were reported in children/adolescents than in adult samples (Westwood et al., 2016). Also, the number of cases who met diagnostic criteria for ASD was higher in inpatients with a more severe form of illness (Wentz et al., 2005).

In this study we found that although ED related symptoms and physical recovery did not differ between groups, there was a greater severity of residual general comorbidity in the group with ASD. The group with ASD traits had had more intensive treatment at baseline and a large proportion of those with probable/possible diagnosis remained in treatment. In the Swedish cohort followed up over 30 years, participants with ASD traits were found to have a poorer global outcome (using Morgan and Russell scales) (Nielsen et al., 2015). Inpatients

with ASD traits and/or diagnosis also didn't improve as much as their non-ASD counterparts from group Cognitive Remediation Therapy (Tchanturia, Larsson, & Adamson, 2016). Interestingly, this study found that although people with ASD engaged with treatment as much as non-ASD, the same was found in another adult inpatient sample (Huke, Turk, Saeidi, Kent, & Morgan, 2014)

Clinical Implications

Patients with ASD comorbidity have a poorer global outcome (with residual problems that relate to their ASD traits), although eating symptoms do appear for the most part to respond to standard care. It is possible that this group need a form of psychosocial intervention which focuses more on social identity and functioning (McNamara & Parsons, 2016). For example, the addition of the New Maudsley method of collaborative care, which equips families with skills training to improve their understanding and support for the individual, was found to improve peer functioning and prosocial behavior in AN patients (Hibbs et al., 2015).

Strengths and Limitations

A major strength of this study was the use of multimodal and multi-informant assessments measures (DAWBA; SAS; SDQ) and the setting within a RCT with repeated assessment measures (*e.g.* monthly weight measures). Nevertheless, given the low prevalence of ASD traits, the study may not have had sufficient power to detect different outcomes. Also, a full cost effectiveness analysis has not been completed. Although this study was representative of adolescents with AN presenting across the UK, there may have been a degree of selection, as carers had to agree to participate in order for adolescents to be included in the study. Also, we

didn’t use a structured clinical interview with patients to diagnose ASD and we didn’t control for the presence of other comorbidities. Finally, the use of a 6-item assessment (SEED) might have impaired our analysis as it didn’t cover all the aspects of ED symptomatology.

Conclusion

For the most part, the eating disorder symptoms in adolescents/young adults with AN and ASD traits resolve in the same time frame, and to the same degree, as those of people with AN without such traits. Continuing problems in social and emotional functioning occurred in those with broad ASD traits and those with an ASD diagnosis.

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Assessment Measures

Patient Assessment Measures. Patients and their parents completed a variety of structured interviews and self-report instruments to assess sociodemographic features, ED symptoms (BMI, SEED), broader clinical characteristics (DAWBA, SDQ, SAS, DASS-21), and clinical service use (CSRI) at intake, 6-months, and 12-months. These are all described below

The Developmental and Well-being Assessment (DAWBA). This is validated measure which generates DSM-IV and ICD-10 psychiatric diagnosis (Goodman, Ford, Richards, Gatward, & Meltzer, 2000). It has excellent discrimination between clinical and healthy cases (McEwen et al., 2016). In the present study, parents (informants) and patients independently completed the autism spectrum diagnostic (ASD) and eating disorders (ED) sections. The computerised interview includes screening questions and skip rules, as well as a free text component (Angold et al., 2012). The strengths and difficulties questionnaire (SDQ) and the social aptitude scale (SAS) form part of the assessment (see below). Afterwards, the computer generates a probability diagnosis that falls into any of six bands, ranging from less than 0.1% or up to 70% chance of a diagnosis. Finally, a psychiatrist trained in the instrument produces the final diagnostic assessment using all of these sources of information. Clinician ratings of the DAWBA were only available at intake.

Strengths and Difficulties Questionnaire (SDQ). A 25 items self-report questionnaire on psychological attributes, with five subscales with five questions each (peer problems, prosocial difficulties, hyperactivity, emotional problems, and conduct problems) and seven scores (the five subescales, total score and impact from total score). It is completed both by informants, in this case parents (I = informants), and by patients (SR = self-reports). It has satisfactory reliability (internal consistency: $\alpha = .73$, cross-informant correlation: $\alpha = .34$, and retest stability: $\alpha = .62$) (Johnson, Hollis, Marlow, Simms, & Wolke, 2014). It is frequently used to compare groups and as a "before" and "after" measure instead of being given a cut-off (Goodman & Scott, 1999).

Social Aptitude Scale (SAS). This is a 10 item measure completed by informants on their child's retrospective social development. It explores behaviours representative of their social aptitude and peer relationships, in real life situations that demand complex social responses. Parents compare their child's abilities to their peers, answering whether they are "a lot worse than average", "a bit worse than average", "about average", "a bit better than average", or "a lot better than average", which are graded on a likert scale from 0 to 4, on items such as "Can work out what people are really thinking and feeling". The lowest possible score is 0 and the highest 40. A score of below 16 is suggestive of an ASD diagnosis with a sensitivity of .93 and a specificity of .93, a positive predictive value of .104 and a negative predictive value of .999. Thus, it can be used to investigate ASD traits or to screen for an ASD diagnosis. This measure taps into different constructs than the SDQ and has low to moderate correlation with it. (Liddle, Batty, & Goodman, 2009).

The Short Evaluation of Eating Disorders (SEED) A 6-item measure of ED symptom severity. The outcomes include a separate severity score for Anorexia Nervosa (ANTSI) (3 items) and Bulimia Nervosa (BNTSI) (3 items). The score from each item

can range from 0 to 3 (0 = symptom not present; 3 = symptom is extreme). A cut-off score hasn't been suggested by authors (Bauer, Winn, Schmidt, & Kordy, 2005).

The Depression, Stress and Anxiety Scale (DASS-21)(Lovibond & Lovibond, 1995). A shortened version of the DASS-42 with good internal consistency on each of the three subscales (Depression, Anxiety and Stress). The subescales have 7 items each and are presented in a likert scale ranging from 0 to 3. It has been validated in the British population and all subescales have shown good internal consistency (Henry & Crawford, 2005).

Parent Measures

The Client Service Receipt Inventory (CSRI). A structured telephone interview conducted by clinical assessors CR and RH measuring use of specialist and generic health services completed by both the patient and parent. It was used to assess the duration (in weeks) and frequency (days/week) of both formal and informal care (adapted for this study). We divided service use into five categories: all inpatient or day patient days; visits to a GP, Practice Nurse (PN) or A&E; outpatient visits (dietician, psychologist, counsellor, ED group therapy, psychotherapist, community/other psychiatric nurse, alternative therapy, crisis intervention, or occupational therapist), family-related services (FBT, outreach, and social worker visits), and all other help (self-help, support groups, telephone help lines, message boards, and print/Internet sources).

Supplementary version of Table 3 - SDQ results across groups including ASD subset

	Diagnostic group	Baseline mesures	12 months measure	Cohen's d (p-value) Baseline vs 12 months	Cohen's d AN only vs AN+Broad ASD (Baseline and 12-months)
Strengths and Difficulties Questionnaire (Self report)					
Total score	**AN only**	16.6 (±5.6) N = 108	14.8 (±6.6) N = 76	.31 (**p= .007**)	.06
	AN+Broad ASD	19.5 (±7.0) N = 22	18.1 (±5.4) N = 18	.29 (p= .058)	
	ASD subset	18.8 (±6.43) N=6	17.33 (±8.14) N=6	1.20 (p= .23)	N.A.
Impact from total score	**AN only**	4.3 (±3.4) N = 108	2.6 (±3.0) N = 76	.51 (**p< .001**)	.51
	AN+Broad ASD	4.6 (±3.8) N = 22	4.7 (±3.5) N = 18	- .03 (p= .94)	
	ASD subset	4.6 (±3.32) **N=6**	4 (± 3.4) **N=6**	.26 (p= .25)	N.A.
Emotional Symptoms	**AN only**	6.6 (±2.2) N = 108	5.6 (±2.7) N = 76	.41 (**p< .001**)	.13
	AN+Broad ASD	6.9 (±2.7) N = 22	6.2 (±2.9) N = 18	.35 (p= .39)	
	ASD subset	6.3 (± 2.65) **N=6**	5.8 (± 3) **N=6**	.28 (p= .45)	N.A.
Hyperactivity	**AN only**	5 (±2.1) N = 108	4.4 (±2.3) N = 76	.29 (**p= .032**)	0
	AN+Broad ASD	5.3 (2.1) N = 22	4.7 (1.9) N = 18	.32 (p= .16)	
	ASD subset	5.5 (± 2.25) **N=6**	4.3 (±2.42) **N=6**	1.49 (p= .10)	N.A.
Peer Problems	**AN only**	2.9 (±1.9) N = 108	2.9 (±1.8) N = 76	0 (p= .84)	.25
	AN+Broad ASD	4.6 (± 2.2) N = 22	5.1 (± 2.0) N = 18	- .29 (p= .97)	

	ASD subset	4.6 (+ 2.58) **N=6**	5.5 (+ 2.16) **N=6**	- .61 (p= .12)	N.A.
Conduct Problems	**AN only**	2.1 (±1.6) N = 108	1.9 (±1.6) N = 76	.11 (p= .18)	- .18
	AN+Broad ASD	2.7 (±1.9) N = 22	2.2 (±1.6) N = 18	.36 (p= .09)	
	ASD subset	2.3 (±1.86) **N=6**	1.6 (±1.63) **N=6**	.56 (p= .15)	N.A.
Prosocial	**AN only**	8.0 (±1.6) N = 108	7.6 (±2.1) N = 76	.20 (**p= .02**)	.17
	AN+Broad ASD	7.5 (±2.0) N = 22	7.4 (±1.9) N = 18	.06 (p= .49)	
	ASD subset	7.3 (±.81) **N=6**	7.5 (±1.51) **N=6**	- .52 (p= .56)	N.A.
Strengths and Difficulties Questionnaire (Parent report)					
Total score	**AN only**	14.8 (±6.6) N = 100	12.4 (±6.9) N = 84	.38 (**p= .015**)	- .15
	AN+Broad ASD	20.6 (±5.4) N = 23	17.2 (±4.9) N=22	.55 (**p= .006**)	
	ASD subset	20.6 (±5.92) N=6	16.3 (±6.43) N=6	2.02 (**p= .03**)	N.A.
Impact from total score	**AN only**	3.5 (±3.1) N = 100	3.0 (±3.4) N = 84	.14 (p= .102)	- .22
	AN+Broad ASD	5.6 (±2.9) N = 23	4.4 (±3.1) N=22	.32 (p= .112)	
	ASD subset	6.6 (±1.5) N=6	4.1 (±2.71) N=6	.79 (p= .104)	N.A.
Emotional Symptoms	**AN only**	6.2 (±2.5) N = 100	5 (±2.8) N = 84	.44 (**p= .001**)	- .04
	AN+Broad ASD	7.7 (±1.4) N = 23	6.4 (±2.2) N=22	.64 (**p= .009**)	
	ASD subset	7.8 (±1.32) N=6	6.5 (±2.88) N=6	.56 (p= .22)	N.A.
Hyperactivity	**AN only**	3.7 (±2.3) N = 100	3.6 (±2.6) N = 84	.04 (p= .47)	.04
	AN+Broad ASD	4.4 (±2) N = 23	4.4 (±1.8) N=22	0 (p= .62)	
	ASD subset	4.3 (±2.33) N=6	3.5 (±2.34) N=6	.41 (p= .059)	N.A.
Peer Problems	**AN only**	2.5 (±2.1) N = 100	2.1 (±1.6) N = 84	.23 (p= .26)	- .24

	AN+Broad ASD	4.9 (±1.7) N = 23	4.0 (±2.3) N=22	.37 (p= .17)	
	ASD subset	6 (±1.26) N=6	5.5 (±2.66) N=6	.18 (p= .58)	N.A.
Conduct Problems	**AN only**	2 (±1.6) N = 100	1.6 (±1.5) N = 84	.25 (**p= .09**)	- .48
	AN+Broad ASD	3.6 (±1.9) N = 23	2.4 (±2) N=22	.80 (**p= .003**)	
	ASD subset	2.5 (±2.16) N=6	.8 (±2.6) N=6	.79 (**p= .04**)	N.A.
Prosocial	**AN only**	8.4 (±1.5) N = 100	7.7 (±1.9) N = 84	.37 (p= .92)	.77
	AN+Broad ASD	5.2 (±2.3) N = 23	5.8 (±2.2) N=22	- .26 (p= .36)	
	ASD subset	4.5 (±1.97) N=6	5.8 (±2.3) N=6	- .84 (p= .07)	N.A.

Legend: N.A. = Not Applicable; SDQ = Strengths and Difficulties Questionnaire; ASD = Autism Spectrum Disorder

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Table 1. Sociodemographic characteristics

Legends: * = p-value of Mann-Whitney tests for medians or Chi-squares for

	AN only (SAS>16) N= 126	**AN+Broad ASD (SAS< 16) N =23**	**AN only vs. AN+Broad ASD differences (Cohen's d; *p*-value)***	**ASD subset N=6**	**Total sample N=149**
Gender (Male:Female; %Female)	11:115 (91.26%)	1:22 (95.65%)	.16; .47	0:6 (100%)	12:137 (91.94%)
Age at baseline (years) Mean (SD)	16.9 (±2.2)	17.0 (±2.0)	.04; .84	16.97 (±1.76)	16.9 (±2.1)
Education in years	11.75 (±2.05)	11.7 (1.67)	.02; .95	11.83 (±1.72)	11.7 (±2)
Age of onset in years (median, range)	14.0 (11.0-20.0)	14.3 (7.0 -19.0)	.12; .39	15 (7-16)	14.0 (7.0-20.0)
Age of diagnosis in years (median,range)	15.0 (12.0-21.0)	15.5 (13.0-20.0)	.11; .95	15.0 (13.0-20.0)	15.0 (12.0-21.0)
Lowest BMI	15.4 (±2.11)	15.7 (±2.6)	- .13; .67	14.68 (±1.03)	15.5 (±2.21)
Illness duration in months	21.92 (±22.19)	24.69 (±23.7)	- .12; .58	17.83 (±15.8)	22.34 (±22.37)
Employment p-value					
Full- or part-time	10 (7.9%)	2 (8.6%%)	.85	0%	12 (8.1%)
Students	105 (83.3%)	20 (87%)	.36	6 (100%)	125 (83.9%)
Other	11 (8.7%)	1 (4.3%)	.47	0%	12 (8.1%)
Living Arrangements at Intake p-value					
With parents	116 (92.1%)	21 (95.5%)	.64	6 (100%)	137 (91.9%)
Alone	0	1 (4.5%)	.01**	0%	1 (0.6%)
Friends/flatmates	4 (3.2%)	0	.39	0%	5 (3.4%)
Uni residence	4 (4.0%)	0	.39	0%	5 (3.4%)
Other	1 (0.8%)	0	.67	0%	1 (0.6%)

frequencies; **= significant at the <.05 level *=significant at the <.001 level**

Table 2. Comparisons of clinical characteristics from baseline to 12 month follow up

	Groups	Baseline	12 month Follow Up	Effect Size -Cohen's d (p-value)	Effect Size (Cohen's d)
BMI	**AN only**	17.0 (±2.2) N=126	18.7 (±2.4) N=101	- .73 (**p< .001**)	.08
	AN+Broad ASD	17.3 (±2.6) N=23	19.2 (±3.1) N=20	- .94 (**p= .001**)	
	ASD subset	16.74 (±2.53) N=6	18.58 (±2.3) N=6	-1.01 (**p= .04**)	N.A.
Weight for Height	**AN only**	82.4 (±11.0) N=114	88.6 (±11.8) N=98	- .52 (**p< .001**)	.07
	AN+Broad ASD	82.9 (±13.3) N=22	90.9 (±15.8) N=20	- .82 (**p= .003**)	
	ASD subset	77.09 (±10.33) N=6	87.61 (±11.58) N=6	-1.05 (p= .13)	N.A.
ANTSI	**AN only**	1.9 (±.6) N=121	1.4 (±.7) N=83	.76 (**p< .001**)	0
	AN+Broad ASD	1.8 (±.6) N=23	1.3 (±.7) N=16	.68 (**p= .005**)	
	ASD subset	1.91 (± .75) N=6	1.33 (± .76) N=6	.75 (p= .11)	N.A.
BNTSI	**AN only**	.8 (±.6) N=113	.5 (± .6) N=107	.48 (**p< .001**)	.52
	AN+Broad ASD	.6 (± .4) N=22	.6 (± .6) N=21	0 (p= .95)	

	ASD subset	.37 (±.34) N=6	.41 (±.46) N=6	- .09 (p= .67)	N.A.
DASS-21	**AN only**	65.7 (±31.1) N=125	49 (±31.2) N=91	.54 (**p< .001**)	.41
	AN+Broad ASD	63.1 (±29.4) N=23	59.3 (±34.9) N=19	.01 (p= .77)	
	ASD subset	61.3 (±34.14) N=6	55.33 (±28.61) N=6	.18 (p= .50)	N.A.
Using psychotropic medication N (%) #	**AN only**	27 (21.4%) N= 125	41 (32.5%) N= 89	.53 (**p< .001**)	.28** (small effect)
	AN+Broad ASD	8 (36.4%) N= 22	12 (54.5%) N= 12	.63 (p = .056)	
	ASD subset	2 (33.3%) N=6	3 (50%) N=6	N.A.	
Antidepressants	**AN only**	26 (20.6%) N= 126	37 (29.4%) N= 90	.45 (**p< .001**)	.20** (small effect)
	AN+Broad ASD	5 (22.7%) N= 22	9 (40.9%) N=18	.59 (p= .07)	
	ASD subset	2 (33.3%) N=6	3 (50%) N=6	N.A.	
Antipsychotics	**AN only**	1 (0.8%) N= 126	8 (6.3%) N=91	.40 (**p = .003**)	.08** (no effect)
	AN+Broad ASD	3 (13.6%) N=22	1 (4.5%) N=18	.27 (p= .39)	
	ASD subset	0 (0%) N=6	1 (16.7%) N=6	N.A.	

Legend: [#] = From total percentage including missing data; Cohen's q = calculated by the correlation difference as suggested by Cohen, 1988;

	Diagnostic group	Baseline mesures	12 months measure	Cohen's d (p-value) Baseline vs 12 months	Cohen's d AN only vs AN+Broad ASD
Strengths and Difficulties Questionnaire (Self report)					
Total score	**AN only**	16.6 (±5.6) N = 108	14.8 (±6.6) N = 76	.31 (**p= .007**)	.06
	AN+Broad ASD	19.5 (±7.0) N = 22	18.1 (±5.4) N = 18	.29 (p= .058)	
	ASD subset	18.8 (±6.43) N=6	17.33 (±8.14) N=6	1.20 (p= .23)	N.A.
Impact from total score	**AN only**	4.3 (±3.4) N = 108	2.6 (±3.0) N = 76	.51 (**p< .001**)	.51
	AN+Broad ASD	4.6 (±3.8) N = 22	4.7 (±3.5) N = 18	- .03 (p= .94)	
	ASD subset	4.6 (±3.32) **N=6**	4 (± 3.4) **N=6**	.26 (p= .25)	N.A.
Emotional Symptoms	**AN only**	6.6 (±2.2) N = 108	5.6 (±2.7) N = 76	.41 (**p< .001**)	.13
	AN+Broad ASD	6.9 (±2.7) N = 22	6.2 (±2.9) N = 18	.35 (p= .39)	
	ASD subset	6.3 (± 2.65) **N=6**	5.8 (± 3) **N=6**	.28 (p= .45)	N.A.
Hyperactivity	**AN only**	5 (±2.1) N = 108	4.4 (±2.3) N = 76	.29 (**p= .032**)	0
	AN+Broad ASD	5.3 (2.1) N = 22	4.7 (1.9) N = 18	.32 (p= .16)	
	ASD subset	5.5 (± 2.25) **N=6**	4.3 (±2.42) **N=6**	1.49 (p= .10)	N.A.
Peer Problems	**AN only**	2.9 (±1.9) N = 108	2.9 (±1.8) N = 76	0 (p= .84)	.25
	AN+Broad ASD	4.6 (± 2.2) N = 22	5.1 (± 2.0) N = 18	- .29 (p= .97)	
	ASD subset	4.6 (± 2.58) **N=6**	5.5 (± 2.16) **N=6**	- .61 (p= .12)	N.A.
Conduct Problems	**AN only**	2.1 (±1.6) N = 108	1.9 (±1.6) N = 76	.11 (p= .18)	- .18
	AN+Broad ASD	2.7 (±1.9)	2.2 (±1.6)	.36	

		N = 22	N = 18	(p= .09)	
	ASD subset	2.3 (±1.86) **N=6**	1.6 (±1.63) **N=6**	.56 (p= .15)	N.A.
Prosocial	**AN only**	8.0 (±1.6) N = 108	7.6 (±2.1) N = 76	.20 (**p= .02**)	.17
	AN+Broad ASD	7.5 (±2.0) N = 22	7.4 (±1.9) N = 18	.06 (p= .49)	
	ASD subset	7.3 (±.81) **N=6**	7.5 (±1.51) **N=6**	- .52 (p= .56)	N.A.
Strengths and Difficulties Questionnaire (Parent report)					
Total score	**AN only**	14.8 (±6.6) N = 100	12.4 (±6.9) N = 84	.38 (**p= .015**)	- .15
	AN+Broad ASD	20.6 (±5.4) N = 23	17.2 (±4.9) N=22	.55 (**p= .006**)	
	ASD subset	20.6 (±5.92) N=6	16.3 (±6.43) N=6	2.02 (**p= .03**)	N.A.
Impact from total score	**AN only**	3.5 (±3.1) N = 100	3.0 (±3.4) N = 84	.14 (p= .102)	- .22
	AN+Broad ASD	5.6 (±2.9) N = 23	4.4 (±3.1) N=22	.32 (p= .112)	
	ASD subset	6.6 (±1.5) N=6	4.1 (±2.71) N=6	.79 (p= .104)	N.A.
Emotional Symptoms	**AN only**	6.2 (±2.5) N = 100	5 (±2.8) N = 84	.44 (**p= .001**)	- .04
	AN+Broad ASD	7.7 (±1.4) N = 23	6.4 (±2.2) N=22	.64 (**p= .009**)	
	ASD subset	7.8 (±1.32) N=6	6.5 (±2.88) N=6	.56 (p= .22)	N.A.
Hyperactivity	**AN only**	3.7 (±2.3) N = 100	3.6 (±2.6) N = 84	.04 (p= .47)	.04
	AN+Broad ASD	4.4 (±2) N = 23	4.4 (±1.8) N=22	0 (p= .62)	
	ASD subset	4.3 (±2.33) N=6	3.5 (±2.34) N=6	.41 (p= .059)	N.A.
Peer Problems	**AN only**	2.5 (±2.1) N = 100	2.1 (±1.6) N = 84	.23 (p= .26)	- .24
	AN+Broad ASD	4.9 (±1.7) N = 23	4.0 (±2.3) N=22	.37 (p= .17)	
	ASD subset	6 (±1.26) N=6	5.5 (±2.66) N=6	.18 (p= .58)	N.A.
Conduct Problems	**AN only**	2 (±1.6) N = 100	1.6 (±1.5) N = 84	.25 (**p= .09**)	- .48

	AN+Broad ASD	3.6 (±1.9) N = 23	2.4 (±2) N=22	.80 (**p= .003**)	
	ASD subset	2.5 (±2.16) N=6	.8 (±2.6) N=6	.79 (**p= .04**)	N.A.
Prosocial	**AN only**	8.4 (±1.5) N = 100	7.7 (±1.9) N = 84	.37 (p= .92)	.77
	AN+Broad ASD	5.2 (±2.3) N = 23	5.8 (±2.2) N=22	- .26 (p= .36)	
	ASD subset	4.5 (±1.97) N=6	5.8 (±2.3) N=6	- .84 (p= .07)	N.A.

Table 3. SDQ results across groups

Strengths and Difficulties Questionnaire (Self report)				

Legend: N.A. = Not Applicable; SDQ = Strengths and Difficulties Questionnaire; ASD = Autism Spectrum Disorder