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## **Anorexia nervosa, autism, and the ADOS: how appropriate is the new algorithm in identifying cases?**

Abstract: Thirty years of scholarship has suggested that anorexia nervosa (AN) may be a ‘female presentation’ of autism, supported by work which has found elevated rates of autism traits and diagnoses among women with clinical levels of AN. These traits are often assessed using the Autism Diagnostic Observation Schedule – 2<sup>nd</sup> Edition (ADOS-2), considered the ‘gold-standard’ tool. Recently, the authors of the ADOS-2 revised the diagnostic algorithm for the adult version of the assessment – the one most often used with AN patients. We therefore examined differences in the scores, rates of diagnosis, and correlations with other mental health issues between the two diagnostic algorithms among women with and without AN. 175 women with current AN, who had recovered from AN, and with no history of AN, between the ages of 12 and 53, took part in an ADOS-2 assessment. Their scores were then calculated according to both the original and the new algorithms. The new ADOS-2 algorithm identifies more women as potentially being on the autism spectrum than the old algorithm. Under both algorithms, more currently ill AN patients were identified as potentially being autistic than those with no history of AN. Recovered individuals represented a mid-point between the scores of those with and without AN on both algorithms. There were no correlations with mental health scores in any group, meaning that the new ADOS-2 algorithm is not falsely identifying anxious behaviours or depressive presentations as signs of autism in this group. Overall, we found that more AN patients and recovered individuals scored above cut-off on the new ADOS-2 algorithm, suggesting that women who experience AN may have more autistic traits which **in part** persist following weight restoration and recovery. However, the ADOS-2 should not be used alone but in combination with broader clinical assessments to determine whether an autism diagnosis is appropriate for these women.

Keywords: anorexia nervosa, autism, comorbidity, women, clinical interview

## 1. Introduction

29 Autism is a neurodevelopmental condition which is present from early childhood, although it  
30 may not be identified until much later, especially in girls and women (1).. It is associated  
31 with a range of difficulties and differences in the realms of social imagination, social  
32 communication, restricted and repetitive behaviours and interests (RRBIs) and sensory  
33 processing(2). Autistic individuals have greater cognitive rigidity than neurotypical controls  
34 (3,4), showing a preference for sameness (5). Autistic people have been also shown to have a  
35 detail-oriented focus over global-oriented focus when undertaking visual search tasks (6,7)  
36 and more generally(8,9). Further, difficulties in social relationships, including social  
37 imagination and social communication difficulties, are a core diagnostic feature of autism (2).

38 Anorexia nervosa (AN) is a complex mental health condition characterised by relentless  
39 pursuit of weight loss and extreme thinness (2). In addition to eating related symptoms,  
40 theoretical models and empirical data suggest that social-emotional and cognitive difficulties  
41 play an important role in the development and progression of AN (10–12). Experimental  
42 findings lend support to these models demonstrating that people with AN show reduced  
43 social-emotional communication, greater attentional bias towards negative emotional cues,  
44 and poorer theory of mind relative to healthy comparison (HC) participants (13–16). Further,  
45 people with AN have also been found to have greater detail focus at the expense of the big  
46 picture, poor cognitive flexibility and strict rule adherence when compared to HCs (17–19).  
47 Together these findings have led to increasing interest in the theorised association between  
48 AN and autism.

49 An association between autism and AN in females has been theorised since the 1980s (20),  
50 and in the decades since there has been a rapid expansion in the amount of research which  
51 supports this connection. A recent systematic review found that between 4.0 – 33.0% of  
52 people with acute AN scored above the cut-off on self-report questionnaire measures  
53 assessing the presence of autistic features (21). The authors also found that studies using  
54 clinician or researcher administered diagnostic interview schedules, such as the Autism  
55 Diagnostic Observation Schedule - 2nd Edition (ADOS-2) (22), found that 4.5 – 53% of  
56 people with acute AN scored above the cut-off for a diagnosis of autism (21). Interestingly,  
57 only one of the included studies examined autistic features among people who had recovered  
58 from AN and reported that 21% of them scored above diagnostic cut-off (23). This is an  
59 interesting finding considering the impact severe malnutrition can have on social and  
60 cognitive functioning, including social withdrawal, difficulties concentrating, and apathy  
61 (24). Taken together, there appears to be an over-representation of autism in acute AN and  
62 further examination of presence of autism among people who have recovered from AN would  
63 be of interest.

64 Recently, the authors of the original ADOS have developed a new diagnostic algorithm for  
65 Module 4 of the schedule, which is designed to be conducted with individuals who are  
66 verbally fluent and for whom it is no longer developmentally appropriate to play with toys  
67 and figurines - i.e. older adolescents and adults (22). This follows a full revision of the other  
68 modules of the original ADOS-G (25) to create the ADOS-2 (22). The new algorithm was  
69 designed to be more sensitive to symptom severity and reflects a move to give more weight to  
70 the sensory sensitivities and sensory-motivated behaviours of autistic people, following the  
71 inclusion of sensory sensitivities in the diagnostic criteria in the Diagnostic and Statistical  
72 Manual - 5th Edition (DSM-5) (2) definition of autism. However, psychomotor agitation,  
73 including tapping, restlessness and fidgeting, may be easily confused as sensory-motivated  
74 behaviours. Therefore, as psychomotor agitation is a common feature of both anxiety and  
75 mood disorders (26), careful assessment of usefulness of the new ADOS-2 Module 4

76 algorithm among highly anxious and depressed individuals, including people with AN, is of  
77 interest.

78 Therefore, in the current study we sought to explore the use of the new ADOS-2 Module 4  
79 algorithm amongst women and adolescent girls with current AN, those who have recovered  
80 from AN (REC), and those who have never experienced an eating disorder (HC). We  
81 expected to see higher levels of autistic traits in patients and recovered individuals than in  
82 healthy controls, both under the old and new ADOS-2 algorithm. We also expected that more  
83 possible autism cases would be identified by the new algorithm than the old algorithm in all  
84 groups. Further to this, we expected that current AN patients would show more autistic  
85 behaviours than recovered individuals, as there is a theory that being in a state of malnutrition  
86 may exacerbate or mimic autistic traits (24). Finally, we also explored the potential  
87 relationships between external presentation of autistic behaviours as measured by the original  
88 and new ADOS-2 algorithms and self-reported mental health as well as state of malnutrition  
89 as measured by body mass index (BMI) within the AN and REC groups.

## 90 **2. Methods**

### 91 **2.1 Participants**

92 175 women and girls between the ages of 12 and 53 took part in the study. Sixty-three were  
93 healthy controls (HC), 66 were currently ill with AN (AN), and 46 were recovered from AN  
94 (REC). The groups were matched in terms of IQ, and each group had a similar ethnic make-  
95 up. All AN and REC participants had clinical diagnoses of anorexia nervosa according to the  
96 Diagnostic and Statistical Manual 5th Edition (DSM-V: American Psychiatric Association,  
97 2013). Participants were recruited from a range of clinical and community sites across the  
98 UK, under ethical approval from the London Surrey Research Ethics Committee (17 / LO /  
99 2071; 17 / LO / 1960). All participants gave written informed consent before taking part in  
100 the study, and written parental consent was obtained for participants under the age of 16. All  
101 procedures were conducted in accordance with the latest version of the Declaration of  
102 Helsinki.

### 103 **2.2 Measures**

104 *2.2.1. AQ-10:* The Autism Quotient-10 item version (27) is a brief 10 item screening  
105 questionnaire assessing the presence of autistic features. The questionnaire gives a maximum  
106 score of 10, and 6 is generally used as the threshold a potential autism case.

107 *2.2.2. EDEQ:* The Eating Disorder Examination Self-Report Questionnaire (28) is a 36-item  
108 self-report questionnaire assessing eating disorder psychopathology over the past 28 days.

109 *2.2.3. HADS:* The Hospital Anxiety and Depression Scale (29) is a 14-item self-report  
110 questionnaire assessing levels of both anxiety and depression over the past two weeks.  
111 Answers are summed for a maximum score of 42. The present study used the total score to  
112 assess level of self-reported mood and anxiety symptoms.

113 *2.2.4. ADOS-2:* The Autism Diagnostic Observation Schedule - 2nd Edition (Lord et al.,  
114 2012) is a clinician- or researcher administered structured observation, generally lasting  
115 between 30 minutes to an hour. It consists of a range of activities and interview questions  
116 designed to elicit behaviours and cognitions traditionally associated with autism. These  
117 visible behaviours and discussions are then scored from 0 - 3 for 'autism severity', with a  
118 score of 3 on any one item reflecting that the person behaved in a highly autistic way, and a  
119 score of 0 indicating that the person behaved as would be expected for a neurotypical  
120 individual. Under the original algorithm, eleven items from the larger scoring matrix are then

121 summed to create an ADOS score, where 7 is the cut-off for being designated as "on the  
122 autism spectrum", and 10 is the cut-off for being designated as "autistic". The new algorithm  
123 comprises two subscales: social affect (SA) and restrictive and repetitive behaviours (RRBs).  
124 For the diagnostic cut-off, the sum of the two subscales is used, with a score of 8 or more  
125 indicating an autism diagnosis.

### 126 **3. General Procedure**

127 Participants were all seen at the Institute of Psychiatry, Psychology and Neuroscience, King's  
128 College London. The data was collected as part of a larger study. Participants completed  
129 demographic information, the EDE-Q, and the HADS as part of online questionnaires. The  
130 larger testing session lasted approximately three hours, including the ADOS-2, a range of  
131 neurocognitive tests, and a structural and functional MRI scan (reported elsewhere). The  
132 ADOS-2 was scored immediately after the testing session by the administering researcher,  
133 and 20% of videos were double coded by another ADOS-2 trained researchers within the  
134 group, resulting in an inter-rater reliability of 87%. Two videos were further included in a  
135 wider reliability meeting with members of other research groups within the institution, and  
136 the inter-rater reliability for these was 81%, with group consensus codes being used in the  
137 final analysis.

### 138 **4. Data Analysis**

139 All data analyses were conducted with R (30). Due to differences in group sizes, presence of  
140 significant heteroscedasticity was assessed using the Breusch-Pagan test (31–33). Where  
141 significant heteroscedasticity was present, group differences in clinical and demographic  
142 measures as well as in ADOS-2 scores were assessed using robust M-estimator with Huber's  
143 approach for controlling for influential outliers (34). In the absence of significant  
144 heteroscedasticity, group differences were investigated with multiple linear regressions.  
145 Significant differences in the number of individuals who met criteria for autism spectrum  
146 diagnosis under the original and new algorithms were examined using generalized linear  
147 binomial mixed model (35). Significance level was set at  $p < 0.05$ .

148 Within the AN and REC groups, Spearman's correlations between ADOS-2 scores under the  
149 original and new algorithms and self-reported clinical variables including eating disorder  
150 symptomatology, depression and anxiety, as well as BMI were explored. Correlations  
151 analyses were corrected for multiple comparisons using false discovery rate set at  $q = 0.05$   
152 and  $p < 0.009$  was considered significant (36).

## 153 **5. Results**

### 154 **5.1 Clinical and demographic characteristics**

155 The sample characteristics are presented in Table 1. As expected, there was a significant  
156 group difference in BMI, with AN participants having a significantly lower BMI than both  
157 HC and REC participants (AN vs. HC:  $t(172) = -10.73$ ,  $p < 0.001$ ; AN vs. REC:  $t(172) = -$   
158  $7.56$ ,  $p < 0.001$ ; HC vs. REC:  $t(172) = 2.12$ ,  $p = 0.089$ ). There was also a significant  
159 difference in age between the groups such that the REC group was significantly older than  
160 the HC ( $t(172) = -3.07$ ,  $p = 0.007$ ) and the AN group ( $t(172) = -3.51$ ,  $p = 0.002$ ). There was  
161 no significant difference in age between the AN and HC participants ( $t(172) = -0.45$ ,  $p =$   
162  $0.896$ ). Finally, there was significant heteroscedasticity in the HADS (BP = 14.78,  $p < 0.001$ ),  
163 EDE-Q (BP = 10.05,  $p = 0.007$ ) and AQ-10 (BP = 9.38,  $p = 0.009$ ) total scores between the  
164 groups, and group differences were examined with a robust M-estimator. As expected the AN  
165 group reported significantly more eating disorder symptomatology than the HC ( $z = 17.21$ ,  $p$



166 < 0.001) and REC groups ( $z = 13.28, p < 0.001$ ). Interestingly, the REC group also reported  
167 significantly more eating disorder symptomatology than the HC group ( $z = -2.59, p = 0.026$ ).  
168 Both AN and REC groups also reported significantly more depression and anxiety than the  
169 HC participants, with the currently ill AN group reporting more mood and anxiety symptoms  
170 than those who were recovered (AN vs. HC:  $z = 13.18, p < 0.001$ ; AN vs. REC:  $z = 6.68, p <$   
171  $0.001$ ; HC vs. REC:  $z = -5.50, p < 0.001$ ). Finally, the AN and REC group also reported  
172 more autistic features than the HC group (AN vs. HC:  $z = 5.07, p < 0.001$ ; AN vs. REC:  $z =$   
173  $1.69, p = 0.210$ ; HC vs. REC:  $z = -2.93, p = 0.009$ ).

174 INSERT TABLE 1 ABOUT HERE

## 175 5.2. ADOS scores

### 176 5.2.1. Original Algorithm

177 The multiple linear regression showed that there was a significant effect of group on ADOS-2  
178 score (Table 2; Figure 1). Post-hoc t-tests revealed that this was driven by a significant  
179 difference between AN patients and HC participants, such that currently ill AN patients  
180 scored significantly higher on the old ADOS-2 algorithm,  $t(172) = 3.68, p < 0.001$ . There was  
181 no significant difference in ADOS-2 scores between the AN and REC groups,  $t(172) = 1.37,$   
182  $p = 0.359$ , or the REC and HC groups,  $t(172) = -1.99, p = 0.118$ .

183 INSERT TABLE 2 ABOUT HERE

184 INSERT FIGURE 1 ABOUT HERE

### 185 5.2.2. New Algorithm

186 Due to significant heteroscedasticity, group differences in ADOS-2 scores calculated based  
187 on the new algorithm were investigated through robust M-estimator. There was a significant  
188 difference between the groups (Table 2; Figure 2), and post-hoc z-tests revealed that this  
189 significance arose from a significant difference between HC participants and the AN patients  
190 ( $z = -4.34, p < 0.00$ , and REC patients,  $z = -2.56, p = 0.028$ ). There was no significant  
191 difference in the new ADOS-2 scores between the AN and REC groups ( $z = 0.192, p =$   
192  $0.134$ ) or HC and REC groups ( $z = -1.72, p = 0.199$ ).

193 INSERT FIGURE 2 ABOUT HERE  
194 5.2.3. Comparing the Original  
and New Algorithms

195 The proportion of participants in each group scoring above the cut-off under the original and  
196 new algorithms are presented in Figure 3. A generalized binomial linear mixed effects model  
197 showed that there was a significant difference in the number of people meeting cut-off for  
198 autism spectrum diagnosis between the original and new algorithms ( $b = -5.18, SE = 2.57, z =$   
199  $-2.02, p = 0.044$ ). Under the original algorithm, five HC participants (7.9%), 13 AN  
200 participants (19.7%), and 7 REC participants (15.2%) scored above the cut-off of 7. Under  
201 the new algorithm, six HC participants (9.5%), 18 AN participants (27.3%), and 9 REC  
202 participants (19.6%) scored above the cut-off of 8.

203 INSERT FIGURE 3 ABOUT HERE

### 204 5.2.4. ADOS and Clinical characteristics

205 Correlations between clinical characteristics and autistic symptomatology assessed with  
206 ADOS-2 original and new algorithms can be seen in Table 3. There was a significant  
207 correlation between HADS total score and ADOS-2 scores and between AQ-10 and ADOS-2  
208 scores within the REC group only under the original algorithm. There were no other

209 correlations between the measures within the AN or the REC group that met the corrected  $p <$   
210 0.009 threshold for significance.

211 INSERT TABLE 3 ABOUT HERE

## 212 6. Discussion

213 The aim of the present study was to investigate the usefulness of the new ADOS-2 Module 4  
214 algorithm amongst a highly anxious and depressed group of people with AN as well as those  
215 who had recovered from AN and people with no history of eating disorders. Importantly, the  
216 new ADOS-2 algorithm identifies significantly more currently ill and recovered AN  
217 individuals as being on the autism spectrum. The scores from the new algorithm did not  
218 correlate significantly with self-reported depression, anxiety, or eating disorder  
219 symptomatology. This suggests that the new ADOS-2 algorithm may be useful in identifying  
220 AN patients who have co-occurring autism, and who may therefore benefit from adapted  
221 treatment approaches which account for their possible cognitive and neurodevelopmental  
222 differences (37,38).

223 As hypothesised, there were significantly more AN participants who met cut-off for autism  
224 diagnosis than HC or recovered participants on both the new and the old ADOS-2 algorithms.  
225 This echoes previous literature that has documented an over-representation of autistic features  
226 among those with AN compared to those without AN (21). Although there were no significant  
227 differences between currently ill AN and recovered participants on their ADOS-2 scores,  
228 inspection of the median scores per group suggested that recovered participants may represent  
229 a mid-point between currently ill AN and HC participants. The present finding could be taken  
230 to suggest that rather than having underlying autism, the fact that acutely ill AN patients present  
231 with more autistic behaviours may be related to state of illness. However, this is in direct  
232 contrast with previous findings showing that similar proportions of participants in currently ill  
233 AN and recovered groups scored above the cut-off on the ADOS-2 (23). Therefore, further  
234 longitudinal work is needed to investigate the stability of autistic features through recovery  
235 among people with AN.

236 This interpretation is bolstered by the lack of significant correlations of new algorithm ADOS-  
237 2 scores with EDE-Q and BMI. This supports the idea that the new ADOS-2 algorithm is not  
238 picking up behaviours associated with anorexia nervosa rather than an underlying autism  
239 diagnosis, and therefore is not overly sensitive in this population resulting in false-positive  
240 autism diagnoses. Furthermore, the fact that the scores on the new ADOS-2 algorithm did not  
241 correlate with self-reported depression or anxiety suggests that this algorithm does not  
242 erroneously pick up behaviours that may be associated with psychomotor agitation. These  
243 findings speak in favour of using the ADOS-2 to assess presence of autistic features not only  
244 among people with eating disorders but also more widely among people with mood and anxiety  
245 disorders.

### 246 6.1. Limitations

247 While this paper highlights the usefulness of the new ADOS-2 algorithm among those with  
248 AN, it also had some limitations. First, it is important to recognise that regardless of  
249 algorithm used, the ADOS-2 alone is not enough to confidently assume that underlying  
250 autism is present in AN patients. While the administration of an ADOS-2 with AN patients  
251 who may be autistic is an important first step, a full clinical assessment, with elements such  
252 as a developmental history, is essential before giving an autism diagnosis. However, if a  
253 patients ADOS-2 scores suggest that autism may be present, it is important to build this into

254 treatment plans as early as possible while waiting for an autism diagnosis appointment, which  
255 can take several months.

256 Second, although the present findings suggest that recovered individuals may represent a  
257 midpoint between currently ill AN and HC participants on the ADOS-2 scores, it is important  
258 to note that the present study was cross-sectional. Therefore, longitudinal work is needed to  
259 further explore the possibility that the presence of autistic features in AN as measured with the  
260 ADOS-2 may be related to illness state rather than a reflection of underlying autism.  
261 Recognising the impact of illness state on ADOS-2 score is crucial as autism is a lifelong  
262 diagnosis, and a false diagnosis could negatively affect ED treatment, as many clinicians report  
263 having low confidence in their ability to work with an autistic person (39).

264 Third, the present study assessed the presence of eating disorder symptomatology, mood and  
265 anxiety symptoms using self-report rather than clinical assessments. To confirm that the  
266 ADOS-2 in general, and the new algorithm in particular, do not erroneously pick up  
267 psychomotor agitation or other behaviour symptoms related to mental health as unusual  
268 sensory interest, replication of the present findings with clinician assessment of mood and  
269 anxiety is key. Mislabelling of psychomotor symptoms as autistic features could generate false  
270 positive diagnoses that may have a negative impact on illness outcome or treatment. Therefore,  
271 further research into the specific nature of these behaviours in those with AN and potential  
272 autism is needed.

273 Fourth, the present study did not have a comparison group of girls and women with a clinician-  
274 confirmed autism diagnosis, who would have given a sense of the changes in ADOS-2 scores  
275 generated by the use of the new algorithm with participants who have established autism, and  
276 whether the differences in our sample are seen more generally. Further, we did not have a  
277 subgroup of participants with AN and clinician-confirmed autism. Inclusion of such a group  
278 would be necessary to fully investigate the sensitivity of the new ADOS-2 algorithm in  
279 detecting autism within this patient population. Therefore, further research assessing the  
280 sensitivity of both the original and new ADOS-2 algorithms under double blind conditions with  
281 autistic and neurotypical participants with and without AN is needed.

282 Finally, the groups were not exactly matched in size and significant heteroscedasticity was  
283 present in some of the measures. Although steps were taken to conduct robust statistical tests  
284 to avoid false findings arising from the presence of heteroscedasticity, future work would  
285 benefit from having larger samples sizes and using purposeful matched sampling, especially  
286 for recovered individuals.

## 287 **7. Conclusions**

288 In conclusion, our findings suggest that the new ADOS-2 algorithm is a useful measure of  
289 autistic traits among women with current AN and who have recovered from AN. Our findings  
290 suggest that some autistic traits remain after recovery, which may reflect a genuine  
291 underlying autism diagnosis. However, the present study is cross-sectional, and the findings  
292 need to be confirmed with a longitudinal study of autistic traits before any firm conclusions  
293 can be drawn.

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304

305 **Author Contributions Statement**

306 FS carried out recruitment, testing, analysis and write-up for this research and manuscript.

307 JK contributed data and to the write-up of this manuscript.

308 JL carried out recruitment, analysis and write-up for this research and manuscript.

309 KT leads the research group within which this work was conducted, and was awarded the  
310 funding which enabled it to take place, as well as proof-reading the manuscript.

311

312 **Conflict of Interest Statement**

313 None of the authors of this work have any personal, professional, or financial relationships  
314 which could be construed as a conflict of interest.

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458

459 Table 1. Demographic and clinical information about participants by group.

Measure	HC Mean (SD)	AN Mean (SD)	REC Mean (SD)	F statistic, p value
Age	21.48 (3.95)	21.14 (5.64)	24.95 (7.43)	$F(2) = 6.94,$ $p = 0.001$
IQ	110.10 (5.56)	108.16 (5.43)	110.30 (5.70)	$F(2) = 1.35,$ $p = .27$
BMI	21.76 (2.15)	17.22 (2.56)	21.01 (2.40)	$F(2) = 60.87,$ $p < 0.001$
EDEQ total	0.82 (0.95)	3.85 (1.37)	1.54 (1.59)	$F(2) = 86.14,$ $p < 0.001$
HADS total	7.10 (4.12)	22.42 (7.89)	13.79 (6.90)	$F(2) = 75.14,$ $p < 0.001$
AQ-10	2.07 (1.49)	3.98 (2.38)	3.42 (2.46)	$F(2) = 12.99,$ $p < 0.001$

460 N.B. IQ = intelligence quotient, BMI = body mass index, EDEQ = Eating disorders  
 461 examination questionnaire, HADS = Hospital anxiety and depression scale, AQ-10 = Autism  
 462 quotient (short version), HC = healthy comparison, AN = anorexia nervosa, REC = recovered  
 463 from anorexia nervosa, SD = standard deviation.

464 Table 2. ADOS-2 scores on the original and new algorithms by group.

Measure	HC Mean (SD)	AN Mean (SD)	REC Mean (SD)	F statistic, p- value
Original algorithm	2.14 (2.35)	4.06 (3.30)	3.28 (3.19)	$F(2) = 6.82,$ $p = 0.001$
New algorithm	3.21 (2.47)	5.65 (3.81)	4.74 (4.06)	$F(2) = 7.97,$ $p < 0.001$

465 N.B. HC = healthy comparison, AN = anorexia nervosa, REC = recovered from anorexia  
 466 nervosa, SD = standard deviation.

467 Table 3. Correlations between clinical characteristics and ADOS-2 original and new scores in  
 468 the AN and REC groups.

Measure	Original algorithm		New algorithm	
	AN	REC	AN	REC
BMI	$\rho = -0.25,$ $p = 0.044$	$\rho = -0.05,$ $p = 0.748$	$\rho = -0.15,$ $p = 0.217$	$\rho = 0.03,$ $p = 0.818$
EDEQ total	$\rho = 0.10,$ $p = 0.453$	$\rho = 0.30,$ $p = 0.046$	$\rho = 0.11,$ $p = 0.420$	$\rho = 0.26,$ $p = 0.089$
HADS total	$\rho = 0.11,$ $p = 0.415$	$\rho = 0.44,$ $p = 0.0027$	$\rho = 0.08,$ $p = 0.552$	$\rho = 0.32,$ $p = 0.032$
AQ-10	$\rho = 0.10,$ $p = 0.461$	$\rho = 0.42,$ $p = 0.005$	$\rho = 0.13,$ $p = 0.318$	$\rho = 0.34,$ $p = 0.026$

469 N.B. HC = healthy comparison, AN = anorexia nervosa, REC = recovered from anorexia  
 470 nervosa, BMI = body mass index, EDEQ = Eating disorders examination questionnaire,  
 471 HADS = Hospital anxiety and depression scale, AQ-10 = Autism Quotient (short version).

472



473 **Figure Legends**

474 Figure 1. Violin and box plots of ADOS-2 total scores under the original algorithm

475 N.B. The black horizontal line indicates the cut-off for autism diagnosis (total score of 7 or  
476 higher). HC = healthy comparison, AN = anorexia nervosa, REC = recovered from anorexia  
477 nervosa. The violin plots demonstrate the density of the scores within each group. The box  
478 plots show the median, interquartile range, minimum and maximum scores within each  
479 group.

480

481 Figure 2. Violin and box plots of ADOS-2 total scores under the new algorithm

482 N.B. The black horizontal line indicates the cut-off for autism diagnosis (total score of 7 or  
483 higher). HC = healthy comparison, AN = anorexia nervosa, REC = recovered from anorexia  
484 nervosa. The violin plots demonstrate the density of the scores within each group. The box  
485 plots show the median, interquartile range, minimum and maximum scores within each  
486 group.

487

488 Figure 3. Proportions of participants in each group scoring above the cut-off under the  
489 original and new algorithms

490 N.B. HC = healthy comparison, AN = anorexia nervosa, REC = recovered from anorexia  
491 nervosa.

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