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Autistic Tendencies in Women with Eating Disorders

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ABSTRACT

Background: We investigated autistic tendencies in Japanese women with eating disorders and a control group of female students. In addition, we analyzed the pathologic characteristics of eating disorder from the perspective of autism.

Methods: Self-reported data from the Autism-Spectrum Quotient (AQ) and Eating Disorder Inventory-91 (EDI-91) instruments were collected from 84 women with eating disorders and 59 female controls.

Results: As compared with controls, total AQ score was significantly higher in women with eating disorders and in those with restricting anorexia nervosa but not in those with bulimia nervosa. Functional deficits associated with autism, such as poor social skills and limited attention to detail and communication, were more prevalent among women with eating disorders, especially those with anorexia nervosa.

Conclusions: Women with eating disorders had higher autism scores than did controls, which suggests that aspects of autism are involved in the pathology of eating disorders. These findings may lead to development of better treatments for women with eating disorders.

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KEYWORDS: eating disorder, anorexia nervosa, bulimia nervosa, pervasive developmental disorder, autistic spectrum disorder, Autism-Spectrum Quotient

The prevalence of eating disorders continues to increase.¹⁾ In addition, the presentation of such disorders is growing more diverse, as indicated by the increasing number of cases among younger and older age groups²⁾ and the increasing duration of the disorders. Although a rough consensus is emerging regarding the pathology and treatment of what is considered the core group of people with eating disorders, much effort and ingenuity is often required in the diagnosis and treatment of these disorders. Some patients have conditions that are not consistent with

conventional diagnostic criteria and may fail to respond to conventional treatments, particularly cases of elderly onset, patients who lack a strong therapeutic relationship, and those with communication difficulties, poor social adjustment before onset of the disorder, and particularly biased tastes or significant fixations.^{3,4)} Comorbidity with conditions such as personality disorders, anxiety disorders, and mood disorders has also been reported.^{5,6)} A group of conditions that has recently begun to attract attention is pervasive developmental disorder, *i.e.*, disorders of social

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interaction, social communication, social imagination, and flexible thinking (including autistic spectrum disorders, Rett disorder, childhood disintegrative disorder, Asperger syndrome, and pervasive developmental disorders not otherwise specified).⁷⁾

An increasing number of studies have reported that comorbidity of eating disorders and developmental disorders is relatively common⁸⁻¹³⁾ and that eating disorder symptoms and autism may be linked.¹⁴⁻¹⁶⁾ However, although there have been numerous reports on anorexia nervosa and autistic tendencies or traits, few comparative studies have examined eating disorders in general, evaluated the autistic tendencies associated with each subtype, or evaluated such tendencies among people without eating disorders.

When pervasive developmental disorders and eating disorders are comorbid, typical treatments such as behavioral therapies that use a dynamic approach, growth model, inner-conflict model, or similar fixed framework may be ineffective and can lead to protracted or intractable symptoms. Studies of Asperger syndrome have shown that perseveration can become directed at body weight and give rise to eating disorders.^{9, 17, 18)} In such comorbid cases, it may be necessary to adapt treatment strategies to the observed traits. This in turn makes it important to study autism in people with diagnosed eating disorders. A better understanding of personality traits might allow for more-individualized treatment and better outcomes.

We compared autistic tendencies and characteristics in women with and without eating disorders and investigated the specific pathologies of eating disorders from the perspective of autism.

Methods

Participants

The participants were 84 Japanese women who were seen as outpatients or inpatients at Toho University Omori Medical Center between June 2004 and September 2010. All patients had received a diagnosis of an eating disorder on their initial visit, as determined by the diagnostic criteria in the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (DSM-IV) of the American Psychiatric Association.⁷⁾ By disorder subtype, 35 had restricting anorexia nervosa (AN-R), 26 had binge-purging anorexia nervosa (AN-BP), 10 had non-purging bulimia nervosa (BN-NP), and 13 had purging bulimia nervosa (BN-P). The control group comprised 59 Japanese female students living in

Tokyo.

Methodology

The objectives of the study were carefully explained to the participants orally and in writing, and questionnaires were given to and collected from them directly by the authors. Height and weight were measured. This study was conducted with the approval of the Toho University School of Medicine Ethics Committee (No. 20016).

Questionnaires

Two self-report questionnaires were used.

1. Autism-Spectrum Quotient (AQ); Japanese version¹⁹⁾

The Autism-Spectrum Quotient (AQ) is a self-report questionnaire²⁰⁾ for adults and consists of 50 questions. Although developed to ascertain the degree of autism in an average adult, this instrument was also designed to function as a clinical screening measure for high-functioning pervasive developmental disorders, to determine the need for more-detailed evaluation. It consists of 10 questions in each of 5 domains characterizing the symptoms of autism. The 5 domains are social skills, attention switching, attention to detail, communication, and imagination. The questionnaire used a forced-choice self-response format that presents the participant with a choice of 4 responses—definitely agree, slightly agree, slightly disagree, and definitely disagree—from which to choose “without thinking too long.” Responses were scored by assigning 1 point for each question answered either slightly or definitely autistically. The Japanese version was created by Wakabayashi et al.¹⁹⁾ and its reliability and suitability have been confirmed. A score of 33 or higher is considered to indicate a clinically significant level of autism in Japanese,¹⁹⁾ and the cutoff point for ruling out high-functioning pervasive developmental disorders is 26 points.²¹⁾

2. Eating Disorder Inventory-91 (EDI-91); Japanese version

The Eating Disorder Inventory (EDI) is a self-report questionnaire developed by Garner²²⁾ to assess physical, psychological, and behavioral traits common to people with eating disorders. It consisted of 91 questions divided into 11 subscales, which correspond to the domains drive for thinness, body dissatisfaction, maturity fears, bulimia, interoceptive awareness, ineffectiveness, perfectionism, interpersonal distrust, impulse regulation, asceticism, and social insecurity. The questionnaire is answered by choosing from 1 of 6 responses for each question: always, usually, often, sometimes, rarely, never. Responses were scored on a 4-point scale of 3, 2, and 1 for answers exhibiting symp-

Table 1 Clinical characteristics of patients and controls

	ED overall (n = 84)	AN-R (n = 35)	AN-BP (n = 26)	AN overall (n = 61)	BN-NP (n = 10)	BN-P (n = 13)	BN overall (n = 23)	Control (n = 59)
Age	24.0 ± 6.6 ⁺⁺	24.8 ± 7.9	23.7 ± 5.8	24.4 ± 7.1	22.3 ± 5.3	23.5 ± 4.9	23.0 ± 5.0	20.0 ± 1.4
Age at onset	19.0 ± 4.5	20.9 ± 5.8 *	18.0 ± 2.3	19.7 ± 4.8	16.8 ± 3.3	17.7 ± 2.4	17.3 ± 2.8	—
Duration of illness (months)	62.9 ± 60.2	47.7 ± 46.0	73.2 ± 73.8	58.6 ± 60.2	74.1 ± 73.8	74.4 ± 50.2	74.3 ± 60.1	—
Body mass index (kg/m ²)	17.0 ± 4.9	13.9 ± 2.2 ^{##}	15.4 ± 1.8 ^{##}	14.6 ± 2.1	25.8 ± 6.1	21.2 ± 2.1	23.2 ± 4.8	—

*p<0.05 vs BN-N ##p<0.01 vs BN-NP, BN-P ++p<0.01 vs control; Tukey multiple-comparison test

ED: eating disorder, AN-R: restricting anorexia nervosa, AN-BP: binge-purging anorexia nervosa, BN-NP: non-purging bulimia nervosa, BN-P: purging bulimia nervosa

Table 2 Comparison of autistic tendencies among women with eating disorders and controls

	ED (n = 84)	Control (n = 59)
AQ total score	24.9 ± 6.8 ^{**}	22.9 ± 5.6
Social skills	5.3 ± 2.6	4.9 ± 2.2
Attention switching	6.0 ± 1.8	5.8 ± 1.9
Attention to detail	4.9 ± 2.2 *	4.1 ± 1.9
Communication	4.9 ± 2.5	4.9 ± 2.0
Imagination	3.5 ± 2.0	3.1 ± 2.0

**p<0.01 *p<0.05 t-test

AQ: Autism-Spectrum Quotient, ED: eating disorder

Table 3 Comparison of autistic tendencies among women with eating disorders and controls

	ED (n = 84)	Control (n = 59)
AQ total score ≥26, n (%)	46 (54.8) ^{**}	18 (30.5)
AQ total score ≥33, n (%)	8 (9.5)	3 (5.1)

**p<0.01 χ^2 test

AQ: Autism-Spectrum Quotient, ED: eating disorder

toms specific to eating disorders, and 0 for the other 3 levels. A higher score indicates more-severe pathology. The present study used the EDI standardized by Shimura et al.²³⁾

Details of surveys

AQ scores were used to qualitatively and quantitatively compare autistic tendencies in the eating disorder group and control group. Next we compared each of the eating disorder subtypes with the control group in relation to total AQ and AQ subtype scores. To identify any association of autistic tendency and body weight with eating disorder pathology, we examined correlations between AQ and EDI and between AQ and body mass index (BMI) for each disorder subtype. Correlations between each AQ and EDI subscale were also examined in the eating disorder group.

Statistical analysis

The statistical software package SPSS 13.0 J for Windows was used for the analyses. The tests included 1-way analysis of variance, and the Tukey multiple comparison test and a *t* test were performed when significant differences were observed. Proportions were compared using the χ^2 test. Pearson correlation coefficients were calculated to investigate associations between EDI and AQ subscales.

To identify associations between BMI, AQ, and EDI, correlation coefficients were obtained after a normal distribution was confirmed with the Shapiro-Wilk test. For each test, differences were treated as statistically significant when *p* was less than 0.05.

Results

Clinical characteristics of participants

Table 1 shows mean age at the time of the survey, age at onset, duration of illness, and BMI among women with eating disorders. Mean age at the time of the survey was 24.0 ± 6.6 years. There were no significant differences in relation to disorder type, and the women with eating disorders were significantly older than those in the control group. Age at onset was 19.0 ± 4.5 years and was significantly higher in the AN-R group than in the BN-NP group. Mean duration of illness was 62.9 ± 60.2 months, and there was no significant difference among subtypes. BMI was 17.0 ± 4.9 and was significantly lower in AN-R than in BN-NP and BN-P. It was also significantly lower in AN-BP than in BN-NP and BN-P.

Autistic tendencies in the eating disorder group and control group

The overall mean AQ score for women with eating disorders was 24.9 ± 6.8, which was significantly higher than the score of 22.9 ± 5.6 for the control group (*p*<0.01; Table 2). The proportion of participants with a score of 33 or

Table 4 Comparison of AQ scores among women with eating disorders and controls

	AN-R (n = 35)	AN-BP (n = 26)	BN-NP (n = 10)	BN-P (n = 13)	AN overall (n = 61)	BN overall (n = 23)	Control (n = 59)
Social skills	5.67 ± 2.59	6.08 ± 2.23 *	4.10 ± 2.38	4.46 ± 3.26	5.85 ± 2.42 ***	4.30 ± 2.85	4.90 ± 2.24
Attention switching	6.23 ± 1.81	6.04 ± 2.13	6.40 ± 0.97	5.85 ± 1.72	6.15 ± 1.93	6.08 ± 1.44	5.80 ± 1.91
Attention to detail	5.17 ± 2.02 **	5.04 ± 2.46	5.20 ± 2.74	4.54 ± 2.15	5.11 ± 2.20 **	4.82 ± 2.38	4.12 ± 1.94
Communication	5.05 ± 2.14	5.54 ± 1.94	4.80 ± 2.44	3.85 ± 2.48	5.26 ± 2.05	4.26 ± 2.45	4.97 ± 2.01
Imagination	3.94 ± 2.21	3.35 ± 1.55	3.60 ± 2.01	3.23 ± 2.52	3.68 ± 1.96	3.39 ± 2.27	3.14 ± 2.00
AQ total	26.08 ± 6.67 **	26.04 ± 5.06 **	24.10 ± 6.79	21.92 ± 8.08	26.06 ± 5.98 ***	22.86 ± 7.46	22.92 ± 5.67

*p<0.05 vs control **p<0.01 vs control #p<0.05 vs BN ##p<0.01 vs BN t-test

AQ: Autism-Spectrum Quotient, AN-R: restricting anorexia nervosa, AN-BP: binge-purging anorexia nervosa, BN-NP: non-purging bulimia nervosa, BN-P: purging bulimia nervosa

Table 5 Correlations between AQ and EDI, AQ and BMI, and EDI and BMI by eating disorder subtype

	ED	AN-R	AN-BP	BN-NP	BN-P
AQ × EDI	0.41 **	0.49 **	0.36	0.30	0.53
AQ × BMI	-0.09	-0.13	0.12	0.27	0.04
EDI × BMI	0.07	0.02	0.17	0.28	0.27

Note: Values are Pearson correlation coefficients.

*p<0.05 **p<0.01

AQ: Autism-Spectrum Quotient, EDI: Eating Disorder Inventory, BMI: body mass index, ED: eating disorder, AN-R: restricting anorexia nervosa, AN-BP: binge-purging anorexia nervosa, BN-NP: non-purging bulimia nervosa, BN-P: purging bulimia nervosa

higher (the cutoff point for clinical autism) was 9.5% (n = 8) among women with eating disorders and 5.1% (n = 3) in the control group (Table 3). The proportion with a score of 26 or higher (the cutoff point for high-functioning pervasive developmental disorders) was 54.8% (n = 46) among women with eating disorders and 30.5% (n = 18) in the control group; the proportion was significantly higher among women with eating disorders ($\chi^2 = 8.24$, $df = 1$, $p < 0.01$).

AQ subscale scores in the eating disorder subgroups and controls

The women with eating disorders had significantly higher scores for total AQ and the “attention to detail” AQ subscale than the control group ($p < 0.05$). The AN group had a significantly higher AQ total score ($p < 0.01$) and “social skill” ($p < 0.05$) and “attention to detail” ($p < 0.01$) scores than the control group; however, no significant differences in AQ total score or any of the subscale scores were observed between the BN group and control group. When stratified by subtype, the AN-R group had a significantly higher AQ total score and “attention to detail” score than

the control group ($p < 0.01$), and the AN-BP group had a higher AQ total score ($p < 0.01$) and “social skill” score ($p < 0.05$; Table 4). The AN group had a significantly higher AQ total score ($p < 0.05$) and “social skill” score ($p < 0.01$) than the BN group.

Correlations between AQ/EDI, AQ/BMI, and EDI/BMI by subtype

The correlations between AQ and EDI, AQ and BMI, and EDI and BMI by eating disorder subtype are shown in Table 5. A moderately positive correlation was observed between AQ and EDI for eating disorders and AN-R ($r = 0.41$, $p < 0.01$, $r = 0.49$, $p < 0.01$). No significant correlation was observed between BMI and either AQ or EDI.

Correlations between AQ and EDI subscales among women with eating disorders

Table 6 shows the correlations between the AQ and EDI subscales among women with eating disorders. The AQ communication subscale was positively correlated with 8 EDI subscales: body dissatisfaction ($r = 0.317$, $p < 0.01$), maturity fears ($r = 0.321$, $p < 0.01$), interoceptive awareness ($r = 0.395$, $p < 0.01$), ineffectiveness ($r = 0.402$, $p < 0.01$), perfectionism ($r = 0.277$, $p < 0.05$), interpersonal distrust ($r = 0.491$, $p < 0.01$), impulse regulation ($r = 0.363$, $p < 0.01$), and social insecurity ($r = 0.427$, $p < 0.01$). Social skills positively correlated with bulimia ($r = 0.216$, $p < 0.05$), interoceptive awareness ($r = 0.250$, $p < 0.05$), ineffectiveness ($r = 0.438$, $p < 0.01$), interpersonal distrust ($r = 0.491$, $p < 0.01$), and social insecurity ($r = 0.451$, $p < 0.05$). Attention switching positively correlated with perfectionism ($r = 0.229$, $p < 0.05$).

Discussion

We investigated the relationship between eating disorders and autism relative to a control group. From a biologi-

Table 6 Correlations between AQ and EDI subscales among women with eating disorders

EDI	AQ				
	Social skills	Attention switching	Attention to detail	Communication	Imagination
Drive for thinness	0.066	0.124	0.010	0.208	-0.056
Body dissatisfaction	0.163	0.170	-0.086	0.317 **	-0.006
Maturity fears	0.197	0.120	0.150	0.321 **	0.070
Bulimia	0.216 *	0.200	-0.088	0.211	-0.194
Interoceptive awareness	0.250 *	0.193	0.159	0.395 **	-0.049
Ineffectiveness	0.438 **	0.167	0.007	0.402 **	0.206
Perfectionism	0.077	0.229 *	0.165	0.277 *	0.005
Interpersonal distrust	0.491 **	0.201	0.095	0.491 **	0.164
Impulse regulation	0.198	0.165	0.104	0.363 **	-0.083
Asceticism	0.061	0.080	0.119	0.132	-0.066
Social insecurity	0.451 *	0.159	0.040	0.427 **	0.099

n = 84 *p<0.05 **p<0.01 Pearson correlation coefficients

AQ: Autism-Spectrum Quotient, EDI: Eating Disorder Inventory

cal perspective, studies have reported that oxytocin levels are diminished in people with autism spectrum disorders and those with eating disorders,²⁴⁾ which suggests that anorexia nervosa is a female variant of the autistic spectrum.¹⁴⁾ The risk of low body weight among patients with autism spectrum disorders has been confirmed in studies of attention to diet.²⁵⁻²⁷⁾ In a study of the comorbidity of eating disorders and autism spectrum disorders, a 5-year follow-up survey²⁸⁾ of 51 patients with anorexia nervosa found that 12% had autism spectrum disorders and 20% had an autistic-like condition. In a subsequent 10-year follow-up survey, Nilsson et al.⁵⁾ and Råstam et al.⁶⁾ reported that 16% of people had autism spectrum disorders and that their outcomes were poor. Regarding eating disorders and autism, Hambrook et al.²⁹⁾ measured the AQ of 22 patients with anorexia nervosa and a control group and found that AQ scores for the anorexia nervosa group were higher than those for the control group.

The present study found that the total AQ score of the patient group was significantly higher than that of the control group. Using a AQ score cutoff point of 33 (the cutoff point of potential abnormality for pervasive developmental disorders and autistic spectrum disorders), there was no significant difference between patients and controls. However, there was a significant difference between these groups when we used a cutoff point of 26 (the cutoff point for high-functioning pervasive developmental disorders). These qualitative data indicate that, on the autism continuum, the proportion of individuals with autism is higher among people with eating disorders than among healthy individuals.

With regard to differences between eating disorder subtypes, Berkman et al.³⁰⁾ reported that comorbidity with autism spectrum disorders was more common, and mortality risk higher, among people with anorexia nervosa than among those with bulimia nervosa. In the present study, AQ scores were significantly higher in the anorexia nervosa group than in the control group, and within this patient group the score for the AN-R subgroup was also significantly higher than that of the controls. In contrast, the score for the women with bulimia nervosa was not significantly different from that of the control group. Thus, although women with eating disorders had significantly higher AQ scores than those of the control group, the AN-R subgroup had the highest scores.

No significant correlation was observed between BMI and AQ or between BMI and EDI, probably because high AQ scores in the eating disorder group might have been less affected by low body weight.

The personality tendencies of women with eating disorders included introversion, compulsiveness, shyness, schizothymia, and selfish immaturity,³¹⁾ which coincided with autism. The 3 domains that characterize pervasive developmental disorders—executive functioning disorders, central coherence disorders, and social/empathic disorders—are also reportedly shared by people with eating disorders. Persons with executive functioning disorders lack cognitive flexibility and have attention-switching difficulty, which have been reported in people with eating disorders as well as in those with pervasive developmental disorders.³²⁾ These conditions are not related to malnutrition,³³⁾ and the symptoms remained even after recovery of body

weight.³⁴⁾ Central coherence traits such as attention to detail and difficulty grasping the overall picture have also been found among people with eating disorders, such as patients with pervasive developmental disorders,³⁵⁾ and studies have found evidence of poor central coherence even after recovery from eating disorders.³⁶⁾ Researchers have also observed that poor central coherence was related to body image disorders, such as drive for thinness of a specific body part and disconnection from whole-body image. Regarding social/empathic disorders, emotional theory issues characteristic of pervasive developmental disorders have also been found in people with eating disorders.^{37, 38)}

On the AQ subscales, scores for attention to detail were significantly higher for the patient group, and scores for social skills and attention to detail were significantly higher among women with anorexia nervosa. As noted above, perseveration becomes directed toward body weight and gives rise to eating disorders in individuals with Asperger syndrome. The present findings provided additional evidence for this hypothesis, as the score for the attention to detail AQ subscale was much higher than that of the control group. The low score for social skills in the anorexia nervosa subgroup also supports the findings of previous studies, which found that stress coping skills were poor in people with eating disorders.³⁹⁾

Coombs et al.¹⁵⁾ studied the associations of AQ scores for attention to detail and communication with eating disorder syndrome in a healthy group. The present findings indicate that the scores for the communication and social skill AQ subscales among women with eating disorders all strongly correlated with the EDI domains of ineffectiveness, interpersonal trust, and social insecurity. These findings suggest that the aspects of autism associated with poor emotional involvement and adaptive communication are involved in the pathology of eating disorders. The correlation between AQ subscales and drive for thinness was weaker than the correlations with the other domains. Although there are many women with eating disorders who did not exhibit a clear drive for thinness, it may be that issues related to communication and social skill have a role in the pathology of eating disorders among such women.

Studies have examined therapeutic approaches to improve social and communication skills among people with Asperger syndrome.^{40, 41)} Such an approach requires assessment of adaptivity and flexibility in daily living and a need to educate people in an adaptively changed manner

to help improve their understanding of words and behavior.^{4, 42)} This treatment approach differs from that used for people with eating disorders, whose therapeutic goal was personal growth and development.⁴³⁾

Cognitive-behavior therapy (CBT) with behavior restriction is the principal treatment for eating disorders, although the rate of improvement is only around 50%. CBT with restriction requires social skills and communication abilities. Okayama et al. found that patients with anorexia nervosa treated with CBT discontinued treatment because of developmental disorders that limited social skills and communication abilities.⁴⁴⁾ This suggests that there may be many women with eating disorders, or with autism and an eating disorder, who do not respond to CBT. Therefore, after identifying the specific characteristics of a disorder, we should offer social-skills training and other therapeutic approaches that improve the social skills of patients with eating disorders and autistic traits.

Limitations

The present study was a cross-sectional study with a small sample size. Although the eating disorder group had higher AQ scores than the control group, it was not possible to determine whether this was due to the high level of AQs, *i.e.*, whether autistic tendencies were premorbidly high, or whether the severity of autism was directly related to susceptibility to eating disorders. Future studies will need to include larger samples and should be conducted in parallel with prospective studies and objective evaluations.

Disorder subtype was categorized at the time of the survey. However, eating disorder subtypes are unstable, and there are reports that anorexia nervosa in particular can be described as “lifetime anorexia nervosa” after a period of 7 years.³⁾ Among the eating disorder subtypes, anorexia nervosa requires considerable attention in the assessment of its characteristics over time.

We found that, due to autism, many patients in this study had communication and adaptation problems in their social life. However, because this study was based on self-report questionnaires, we did not evaluate all patients. We believe that the next stage of this study is to investigate the clinical aspects of eating disorders comorbid with autism.

Conclusion

Women with eating disorders were more likely to have autism than were healthy individuals. Among women with

eating disorders, those with anorexia nervosa had the highest proportion of autism. However, women with bulimia nervosa did not have a higher rate of autism. These findings suggest that aspects of autism associated with poor social skills and communication may be associated with the pathology of eating disorders. The present survey was based on data from a self-report questionnaire and consequently has certain limitations. However, investigating autistic tendencies may lead to more-appropriate treatments for women with eating disorders, who often find community life to be difficult when they begin treatment.

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摂食障害における自閉性傾向の調査

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要約

目的：一般健常人と比較した摂食障害患者における自閉性傾向について検討し、自閉性の観点から摂食障害の病態について報告を行う。

方法：84人の女性摂食障害患者と59人の女性対照群に対し、自己記入式の質問紙、自閉性スペクトル指数日本版 (Autism-Spectrum Quotient: AQ) と、日本語版 Eating Disorder Inventory-91 (EDI-91) を行い、比較検討した。

結果：AQ合計点は、摂食障害群は対照群より有意に高かった。Anorexia nervosa restricting type (AN-R) のAQ値は対照群より有意に高かった。これに対して、bulimia nervosa (BN) は対照群と有意差を認めなかった。

結論：摂食障害患者では、健常人以上の自閉性を有していた。社会性やコミュニケーションを苦手とする自閉性の一側面が摂食障害の病理に影響を与えていることが示唆された。自閉性傾向を調べることは、摂食障害患者に対するより適切な治療法の選択にも結び付くと考えた。

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