

# Parental broader autism phenotype and its association with adolescent social anxiety

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## ABSTRACT

**Objective:** Social anxiety disorder (SAD) and autism spectrum disorder (ASD) share overlapping social-cognitive features. The broader autism phenotype (BAP), reflecting subclinical autistic traits in parents, may be relevant in understanding adolescent social anxiety within a family context. This study aimed to examine the association between parental BAP traits and social anxiety severity in adolescents.

**Materials and Methods:** In this study, 109 adolescents with SAD (aged 11–17 years, 79.8% female) and their parents (109 mothers and 109 fathers) were included. Adolescents completed the Social Anxiety Disorder Severity Scale–Child Version, while parents completed the Autism Spectrum Quotient (AQ) and the Social Responsiveness Scale (SRS), used as a secondary exploratory measure of social functioning. Non-parametric analyses and binary logistic regression were performed.

**Results:** Greater SAD severity was associated with lower paternal AQ scores ( $p=-0.29$ ,  $p=0.002$ ). In addition, adolescents in the higher-severity SAD group had significantly higher SRS scores compared to those in the lower-severity group ( $p=0.003$ ).

**Conclusion:** Parental BAP traits, particularly paternal autistic traits, may be associated with social anxiety severity in adolescents. However, due to the cross-sectional design, reliance on questionnaire-based measures, and potential shared-informant bias, these findings should be interpreted cautiously and considered hypothesis-generating rather than confirmatory.

**Keywords:** Adolescents, autism spectrum disorder, phenotype, parents, social phobia

## Introduction

Social anxiety disorder (SAD) is a common psychiatric condition characterized by an intense fear of negative evaluation by others, leading to avoidance of social interactions (1). Core features of SAD, such as impaired social communication, poor social skills, and avoidance behaviors, show notable symptomatic overlap with autism spectrum disorder (ASD) (2,3). ASD is a neurodevelopmental disorder defined by deficits in social interaction and communication, as well as restricted and repetitive patterns of behavior (1). Both conditions share difficulties in social cognition, emotion recognition, and sensitivity to social stimuli, occasionally leading to diagnostic ambiguity (4). These overlaps extend beyond observable symptoms and may reflect shared social-cognitive and affective mechanisms, including reduced social attention, heightened self-focused attention, and challenges in emotional expressiveness (2,5). Consequently, individuals with SAD may exhibit elevated levels of autistic traits even without meeting the diagnostic threshold for ASD (6,7). For example, neurotypical individuals with higher autistic traits have been shown to

experience greater social anxiety and social skill difficulties compared to those with lower autistic traits (8).

Importantly, such elevated autistic-like traits in adolescents with SAD may not necessarily indicate underlying neurodevelopmental pathology but may instead arise from these shared mechanisms. In particular, heightened fear of negative evaluation and chronic social withdrawal—central features of SAD—may behaviorally overlap with social-communication difficulties assessed in autism-related trait measures (4,5), while also limiting opportunities for social learning over time.

Autistic traits are now understood to exist on a continuum across the general population, not only among individuals diagnosed with ASD (9,10). This conceptualization aligns with the notion of the broader autism phenotype (BAP), which refers to subclinical manifestations of autistic-like traits that resemble ASD but are milder in degree (11). BAP traits are frequently observed in the parents of individuals with ASD and include subtle social communication difficulties, introversion, rigidity, and atypical pragmatic language use

(12,13). Although these traits are not typically impairing at a clinical level, they may influence intrafamilial social learning processes and contribute to the intergenerational transmission of socio-cognitive styles. Parenting behaviors and family interaction patterns have been proposed as mechanisms through which parental characteristics may influence children's social and emotional development (5,14). In the present study, parental BAP traits were conceptualized as individual characteristics within the broader familial context. Although research on the broader autism phenotype (BAP) has expanded, parental autistic traits are often examined as composite familial characteristics rather than distinguishing between maternal and paternal contributions (11,15). Evidence suggesting divergence in paternal and maternal self-reports underscores the importance of evaluating parental traits separately (16). Accordingly, the present study independently examines maternal and paternal BAP traits in the parents of adolescents diagnosed with social anxiety disorder. Parental BAP traits are rarely examined separately in SAD. Building on this rationale, the present study aimed to investigate the association between maternal and paternal broader autism phenotype traits and social anxiety severity in a clinically diagnosed sample of adolescents with SAD. We further explored whether parental BAP traits were associated with adolescents' social responsiveness. We hypothesized that higher parental BAP traits would be associated with greater social anxiety severity in adolescents.

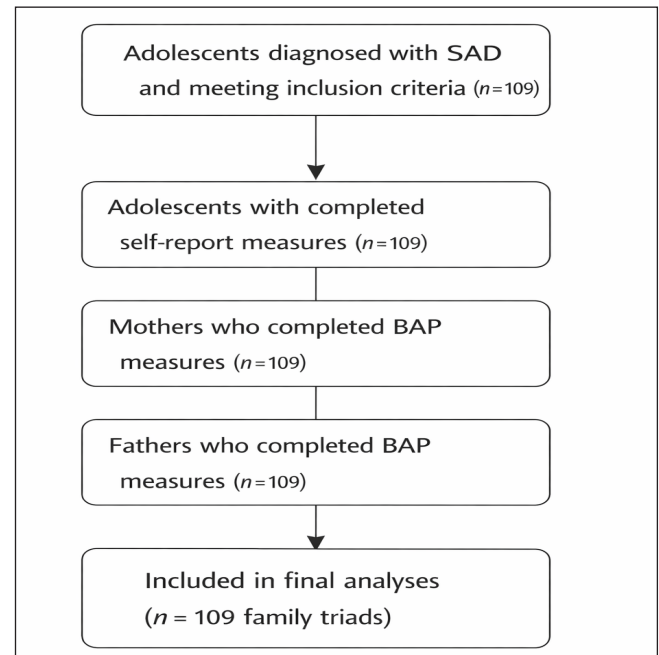
## Materials and Methods

### Participants

The study included 109 adolescents aged 11–17 years (87 females, 22 males) diagnosed with social anxiety disorder according to DSM-5 criteria, along with their parents (109 mothers and 109 fathers), who were assessed between January 2024 and June 2024. Participants were recruited from department of child and adolescent psychiatry, Ankara Bilkent City Hospital, where diagnoses of social anxiety disorder and other psychopathologies were established by trained child and adolescent psychiatrists using the semi-structured Schedule for Affective Disorders and Schizophrenia for School-Age Children—Present and Lifetime Version, DSM-5 Turkish Adaptation (K-SADS-PL-DSM-5-T) (17). The sample consisted of all eligible adolescents diagnosed with social anxiety disorder who met the inclusion criteria and were assessed during the study period. Adolescents with major psychiatric conditions (e.g., autism spectrum disorder, psychosis, or bipolar disorder) were excluded, and all participants were considered to have normal intellectual functioning based on clinical evaluation, academic performance, and absence of intellectual disability. None of the participants had received prior psychiatric medication at the time of assessment. Only adolescents living with both parents were included to ensure accurate parental assessment of the BAP traits, which may limit generalizability and introduce selection bias. Both mothers and fathers provided BAP data. The participant selection process is illustrated in Figure 1.

### Clinical Measures

**Sociodemographic Data Form:** This form was developed by the researchers to collect information on participants'



**Figure 1:** Flow chart of participant selection and inclusion of 109 family triads.

sociodemographic characteristics, developmental history, and medical background. The interview gathers data on the individual's medical background, family history of physical and psychiatric conditions, treatment history, symptom trajectory, developmental milestones, medication use, and sociodemographic profile.

**Social Anxiety Disorder Severity Scale – Child Version (SADSS-C):** This 10-item scale assesses the severity of social anxiety symptoms in adolescents aged 11–17 and is used for both initial evaluation and follow-up (18). It is the first measure based on DSM-5 criteria, and the Turkish version has demonstrated good validity and reliability (19). Total scores range from 0 to 40, with higher scores indicating greater symptom severity. In this study, scores were analyzed both continuously and categorically; moderate to extreme social anxiety was considered clinically significant and compared with none to mild levels of social anxiety. Participants were categorized into lower versus higher social anxiety severity groups based on the clinician-rated average total score of the DSM-5 Social Anxiety Disorder Severity Scale. Average scores of  $\leq 1$  (none to mild) were classified as the lower-severity group, whereas scores of  $\geq 2$  (moderate to extreme) were classified as the higher-severity group for analytic purposes (19).

**Social Responsiveness Scale (SRS):** This scale was developed to identify ASD by distinguishing children with ASD from typically developing children and those with other psychiatric conditions (20). It assesses parents' perceptions of their child's social understanding and responsiveness across five domains: social awareness, social cognition, social communication, social motivation, and autistic mannerisms. The scale reflects the core domains of autism, demonstrates strong validity relative to the Autism Diagnostic Interview, and shows good internal consistency (Cronbach's  $\alpha=0.86$ ) in

school-age children (20,21). Higher scores indicate greater social impairment. Although a formally published large-scale Turkish validation study providing age- and sex-normed T-scores for adolescents is not currently available, the SRS has been previously utilized in Turkish clinical samples (21,22). In the present study, the SRS was included as a secondary, exploratory measure of social functioning. Raw scores were analyzed within the sample, and findings should be interpreted cautiously due to the lack of normative data. The SRS was completed by one of the parents; however, the specific informant (mother or father) was not systematically recorded.

**Autism Spectrum Quotient (AQ):** The AQ is a standardized self-report measure assessing the broader autism phenotype in adults and was completed by all parents in the study (23). The 50-item scale evaluates five domains—social skills, communication, imagination, attention switching, and attention to detail—with higher scores indicating greater autistic traits. Total scores range from 0 to 50, and the Turkish version has demonstrated good validity and reliability (24). Participants were categorized into “lower autistic traits” and “elevated autistic traits” groups based on a cutoff score of 26 on the Autism Spectrum Quotient, in line with previous literature (25).

**Schedule for Affective Disorders and Schizophrenia for School-Age Children—Present and Lifetime Version, DSM-5 November 2016-Turkish Adaptation (KSADS-PL-DSM-5-T):** The K-SADS-PL, developed by Kaufman et al. (26), is a semi-structured interview assessing current and lifetime psychiatric disorders in children and adolescents. The Turkish DSM-5 version has demonstrated good validity and reliability and was used in this study to confirm SAD diagnoses and identify comorbid psychiatric conditions (17).

### Statistical analysis

Statistical analysis were performed using IBM SPSS Statistics version 25. Categorical variables were presented as counts and percentages, whereas continuous variables were summarized as medians and interquartile ranges (IQR). The normality of continuous variables was assessed using the Kolmogorov–Smirnov test. Because several key variables were not normally distributed, non-parametric methods were used. Categorical variables were compared using the chi-square test, and continuous variables using the Mann–Whitney U test. Associations between continuous or ordinal variables were evaluated using Spearman's rank correlation coefficient. Correlation coefficients were interpreted as weak ( $p=0.01$ – $0.29$ ), moderate ( $p=0.30$ – $0.70$ ), or strong ( $p=0.71$ – $0.99$ ).

Effect sizes were calculated to aid interpretation of the results. For chi-square tests, effect size was assessed using Cramer's V. For Mann–Whitney U tests, effect size was calculated as  $r=Z/\sqrt{N}$ , where Z represents the standardized test statistic and N is the total sample size. Effect sizes were interpreted according to Cohen's criteria as follows:  $r<0.10$  negligible,  $r<0.30$  small,  $0.30 \leq r<0.50$  medium, and  $r \geq 0.50$  large (27). Primary analyses examining the association between parental AQ scores and adolescent social anxiety severity were hypothesis-driven. Analyses involving SRS and AQ subscale scores were considered exploratory. Formal correction procedures for multiple comparisons were

not applied to avoid increasing the risk of Type II error in these exploratory analyses. Furthermore, due to the modest sample size and group imbalance, a post-hoc power analysis was conducted using G\*Power 3.1. Based on group differences and observed variability in total SRS scores and paternal AQ scores across SAD severity groups, the estimated statistical power ( $1-\beta$ ) ranged between 93% and 99%. Univariable analyses were initially performed to explore associations between adolescent and parental traits. Variables showing statistical significance in these analyses ( $p < 0.050$ ) were subsequently entered into multivariable binary logistic regression models using the enter method to identify potential predictors of elevated social anxiety and autistic traits in adolescents. The dependent variables were coded as categorical outcomes, and the strength of associations was expressed as odds ratios (ORs) with 95% confidence intervals. Statistical significance was set at  $p < 0.050$  for all statistical tests.

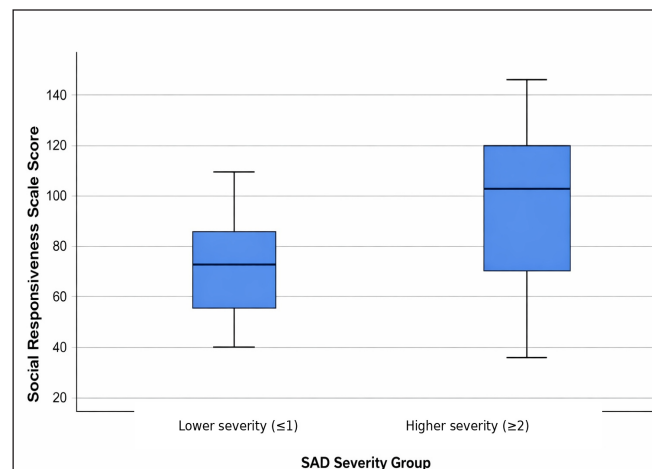
## Results

### Sociodemographic and clinical characteristics

The study sample consisted of 109 adolescents, 79.8% of whom were female, with a median age of 15 years (IQR: 14–16). Analyses examining the effects of sociodemographic and medical characteristics on the severity of social anxiety revealed that moderate to severe levels of social anxiety were more prevalent among females (86.2%) than males (63.6%). An increase in the number of siblings was also found to be associated with the presence of higher severity social anxiety ( $p=0.037$ ). No significant associations were found between higher severity social anxiety and the adolescent's or their family's history of medical or psychiatric disorders (see Table I for exact p-values).

### Correlation analysis

When examining the correlations between participants' total scores on the Social Anxiety Disorder Severity Scale and the total scores on the SRS, AQ-Mother, and AQ-Father scales, a low-level negative correlation was found between the severity of social anxiety and the AQ-Father score ( $p=-0.29$ ,  $p=0.002$ ). The remaining correlation analysis results are presented in Table II.



**Figure 2:** Comparison of total SRS scores between lower- and higher-severity social anxiety groups

**Table I: Relationship between participants' sociodemographic and medical characteristic and social anxiety severity**

|                                             | Social anxiety severity |                  | Total            | p     | r    |
|---------------------------------------------|-------------------------|------------------|------------------|-------|------|
|                                             | Lower-severity          | Higher-severity  |                  |       |      |
| Gender*                                     |                         |                  |                  |       |      |
| Female                                      | 12 (13.8)               | 75 (86.2)        | 87 (79.8)        | 0.027 | 0.23 |
| Male                                        | 8 (36.4)                | 14 (63.6)        | 22 (20.2)        |       |      |
| Age†                                        | 14.9 (13.0-16.0)        | 15.0 (14.0-16.0) | 15.0 (14.0-16.0) | 0.252 | 0.11 |
| Number of siblings†                         | 1.0 (1.0-2.0)           | 2.0 (1.0-3.0)    | 2.0 (1.0-2.0)    | 0.037 | 0.20 |
| Psychiatric history in siblings*            |                         |                  |                  |       |      |
| No                                          | 18 (20.7)               | 69 (79.3)        | 87 (79.8)        | 0.354 | 0.12 |
| Yes                                         | 2 (9.1)                 | 20 (90.9)        | 22 (20.2)        |       |      |
| Presence of comorbid psychiatric disorders* |                         |                  |                  |       |      |
| No                                          | 19 (19.4)               | 79 (80.6)        | 98 (89.9)        | 0.685 | 0.08 |
| Yes                                         | 1 (9.1)                 | 10 (90.9)        | 11 (10.1)        |       |      |
| Presence of comorbid medical conditions*    |                         |                  |                  |       |      |
| No                                          | 17 (17.3)               | 81 (82.7)        | 98 (89.9)        | 0.420 | 0.08 |
| Yes                                         | 3 (27.3)                | 8 (72.7)         | 11 (10.1)        |       |      |
| Mother's age†                               | 44.5 (38.0-46.5)        | 42.0 (39.0-47.0) | 43.0 (39.0-47.0) | 0.641 | 0.04 |
| Mother's education*                         |                         |                  |                  |       |      |
| Middle school and below                     | 8 (24.2)                | 25 (75.8)        | 33 (30.3)        | 0.295 | 0.10 |
| High school and above                       | 12 (15.8)               | 64 (84.2)        | 76 (69.7)        |       |      |
| Maternal psychiatric history*               |                         |                  |                  |       |      |
| No                                          | 17 (19.5)               | 70 (80.5)        | 87 (79.8)        | 0.759 | 0.06 |
| Yes                                         | 3 (13.6)                | 19 (86.4)        | 22 (20.2)        |       |      |
| Maternal medical history*                   |                         |                  |                  |       |      |
| No                                          | 13 (15.3)               | 72 (84.7)        | 85 (78.0)        | 0.140 | 0.15 |
| Yes                                         | 7 (29.2)                | 17 (70.8)        | 24 (22.0)        |       |      |
| Father's age†                               | 46.0 (42.5-50.0)        | 46.0 (42.0-49.0) | 46.0 (42.0-50.0) | 0.618 | 0.05 |
| Father's education*                         |                         |                  |                  |       |      |
| Middle school and below                     | 4 (20.0)                | 16 (80.0)        | 20 (18.3)        | 0.760 | 0.02 |
| High school and above                       | 16 (18.0)               | 73 (82.0)        | 89 (81.7)        |       |      |
| Paternal psychiatric history*               |                         |                  |                  |       |      |
| No                                          | 20 (19.8)               | 81 (80.2)        | 101 (92.7)       | 0.347 | 0.13 |
| Yes                                         | 0 (0.0)                 | 8 (100.0)        | 8 (7.3)          |       |      |
| Paternal medical history*                   |                         |                  |                  |       |      |
| No                                          | 15 (17.9)               | 69 (82.1)        | 84 (77.1)        | 0.775 | 0.02 |
| Yes                                         | 5 (20.0)                | 20 (80.0)        | 25 (22.9)        |       |      |

\*:  $n(\%)$  (Chi-square test), †: median (IQR) (Mann-Whitney U test), r: Effect size

**Table II: Correlation analysis between participants' total scores on the SAD, SRS, AQ-mother, and AQ-mather scales**

|      | SAD    | SRS    | AQ_M  | AQ_F  |
|------|--------|--------|-------|-------|
| SRS  |        |        |       |       |
| rho  | 0.099  | 1.000  | -     | -     |
| p*   | 0.306  | -      | -     | -     |
| AQ-M |        |        |       |       |
| rho  | -0.145 | -0.080 | 1.000 | -     |
| p*   | 0.132  | 0.407  | -     | -     |
| AQ-F |        |        |       |       |
| rho  | -0.293 | -0.441 | 0.127 | 1.000 |
| p*   | 0.002  | 0.001  | 0.188 | -     |

\*: Spearman correlation test, rho: Spearman rank correlation coefficient (two-tailed), SAD: Social Anxiety Disorder, SRS: Social Responsiveness Scale, AQ\_M: Maternal Autism Spectrum Quotient total score, AQ\_F: Paternal Autism Spectrum Quotient total score

### Group comparisons based on SAD severity

Based on the clinician-rated average total scores of the Social Anxiety Disorder Severity Scale, participants were categorized into two groups for analytic purpose: the lower-severity group ( $\leq 1$ ) and the higher-severity group ( $\geq 2$ ). Of the 109 participants, 20 were classified in the lower-severity

**Table III: Comparison of total SRS, AQ-Mother, and AQ-Father scores Across clinical groups of social anxiety disorder severity**

|            | Social anxiety disorder severity |                          | p      | r    |
|------------|----------------------------------|--------------------------|--------|------|
|            | Lower-severity                   | Higher-severity          |        |      |
| SRS*       | 79.50<br>(62.00-91.50)           | 107.00<br>(72.00-123.00) | 0.003  | 0.29 |
| AQ-Mother* | 19.00<br>(18.00-20.50)           | 19.00<br>(16.00-21.00)   | 0.373  | 0.07 |
| AQ-Father* | 21.50<br>(18.00-24.00)           | 16.00<br>(14.00-19.00)   | <0.001 | 0.38 |

\*: median (IQR) (Mann-Whitney U test), SRS: Social Responsiveness Scale, AQ: Autism Spectrum Quotient, r: Effect size

group ( $\leq 1$ ) and 89 in the higher-severity group ( $\geq 2$ ) based on the predefined cutoff criteria described in the Methods section. The SRS total scores differed significantly between the two groups, with adolescents in the higher-severity SAD group showing higher scores compared to those in the lower-severity SAD group (107 [72–123] vs. 80 [62–92], respectively;  $p=0.003$ ) (Table III, Figure 2). Although AQ-Mother total scores did not differ significantly between groups ( $p=0.373$ ), the higher-severity SAD group showed



**Table IV: Comparison of participants' social anxiety disorder severity with AQ-Mother and AQ-Father subscale scores**

|                                | Social Anxiety Disorder Severity |                        | p      | r    |
|--------------------------------|----------------------------------|------------------------|--------|------|
|                                | Lower-severity                   | Higher-severity        |        |      |
| AQ-Mother Social Skills*       | 3.00<br>(2.00- 4.50)             | 3.00<br>(2.00- 5.00)   | 0.845  | 0.02 |
| AQ-Mother Attention Switching* | 5.00<br>(3.00- 6.00)             | 5.00<br>(4.00-6.00)    | 0.355  | 0.09 |
| AQ-Mother Attention to Detail* | 6.00<br>(5.00-7.50)              | 4.00<br>(3.00-5.00)    | <0.001 | 0.33 |
| AQ-Mother Communication*       | 2.50<br>(1.50-3.00)              | 3.00<br>(1.00-4.00)    | 0.747  | 0.03 |
| AQ-Mother Imagination*         | 3.50<br>(3.00-4.50)              | 3.00<br>(2.00-4.00)    | 0.429  | 0.08 |
| AQ-Mother Total Score*         | 19.00<br>(18.00-20.50)           | 19.00<br>(16.00-21.00) | 0.373  | 0.07 |
| AQ-Father Social Skills*       | 4.00<br>(2.00-5.00)              | 2.00<br>(2.00-4.00)    | 0.012  | 0.24 |
| AQ-Father Attention Switching* | 5.00<br>(3.50-6.00)              | 4.00<br>(3.00-6.00)    | 0.250  | 0.11 |
| AQ-Father Attention to Detail* | 5.00<br>(3.00-6.00)              | 4.00<br>(2.00-5.00)    | 0.019  | 0.22 |
| AQ-Father Communication*       | 3.00<br>(2.00-5.00)              | 2.00<br>(1.00-3.00)    | <0.001 | 0.37 |
| AQ-Father Imagination*         | 5.00<br>(4.00-6.00)              | 4.00<br>(3.00-5.00)    | 0.014  | 0.24 |
| AQ-Father Total Score*         | 21.50<br>(18.00-24.00)           | 16.00<br>(14.00-19.00) | <0.001 | 0.38 |

\*: median (IQR) (Mann-Whitney U test), **AQ:** Autism Spectrum Quotient, **r:** Effect size

notably lower AQ-Father total scores compared to the lower-severity SAD group (16 [14–19] vs. 22 [18–24], respectively;  $p < 0.001$ ) (Table III).

### AQ subscale analyses

When comparing AQ subscale scores of mothers and fathers based on the severity of adolescents' social anxiety, the AQ-Mother attention to detail subscale score was significantly lower in the higher-severity SAD group ( $p < 0.001$ ). For fathers, the social skills ( $p = 0.012$ ), attention to detail ( $p = 0.019$ ), communication ( $p < 0.001$ ), and imagination ( $p = 0.014$ ) subscale scores were also significantly lower in the higher-severity SAD group compared to the lower-severity group. The remaining AQ subscale scores for each parent did not show statistically significant differences (see Table IV for exact  $p$ -values).

### Multivariable logistic regression analyses

In the multivariable analysis model constructed with variables found to be significant in the univariable analyses, it was shown that female adolescents had approximately four times higher odds of being classified in the higher-severity SAD group compared to males (OR=4.046, 95% CI: 1.142–14.334,  $p = 0.030$ ). Additionally, each one-point increase in the AQ-Father total score was associated with lower odds of being classified in the higher-severity SAD group (OR=0.810, 95% CI: 0.709–0.924,  $p = 0.002$ ) (Table V).

### Associations between parental AQ and SRS

The participants' SRS scores were compared with their parents' AQ scores. No statistically significant association was observed between the AQ-Mother total scores and the child's SRS score ( $p = 0.125$ ). In contrast, children whose fathers had lower AQ scores exhibited higher median SRS scores [99.5 (71.0–122.0)] compared with children whose fathers had higher AQ scores [63.0 (55.0–91.0)], and this difference was statistically significant ( $p = 0.017$ ). These findings suggest an association between paternal AQ scores and adolescents' social responsiveness characteristics within this clinical sample (Table VI).

### Discussion

This study examined autism spectrum-related traits in adolescents with SAD and BAP characteristics in their parents. Greater SAD severity was associated with increased difficulties in social responsiveness, as reflected by higher Social Responsiveness Scale scores, suggesting that higher social anxiety severity was associated with greater social interaction difficulties within the sample. These findings are consistent with previous research suggesting overlapping social cognitive deficits in SAD and ASD, including impairments in social attention, communication, and emotional expression (2,3). Social anxiety has also been linked to shared cognitive and emotional mechanisms—such as intolerance of uncertainty, alexithymia, sensory sensitivity, and maladaptive emotion regulation—in both typically developing adolescents and those with autistic traits (2, 13). Moreover, higher autistic traits have been associated with increased social anxiety and social communication difficulties even in neurotypical populations (8). Together, these findings highlight the phenotypic overlap between social anxiety and autism-related traits and underscore the need for cautious interpretation of trait-based measures in clinical SAD samples.

One of the most notable findings was the inverse association between paternal AQ scores and adolescent SAD severity, such that higher paternal AQ scores were associated with lower odds of belonging to the higher-severity SAD group within this cross-sectional sample.

This unexpected inverse association has not been widely reported in the literature and may offer a novel perspective on the role of paternal traits in adolescent social anxiety. This finding should be interpreted cautiously and does not provide evidence of a directional or protective relationship. Given the cross-sectional design and reliance on questionnaire-based measures with shared informants, alternative explanations such as measurement bias, informant effects, and sampling variability must be carefully considered.

In addition to these methodological considerations, several alternative mechanisms may account for the observed inverse association. One possibility is that fathers with lower levels of autistic traits may hold higher social expectations and place greater implicit demands on their children regarding social performance. According to cognitive-behavioral models of social anxiety, heightened perceived social expectations and fear of negative evaluation are central mechanisms in the

**Table V: Multivariable logistic regression analysis of factors influencing social anxiety disorder severity in participants**

|                       | Social Anxiety Disorder Severity |                 | Univariable          |        | Multivariable         |       |
|-----------------------|----------------------------------|-----------------|----------------------|--------|-----------------------|-------|
|                       | Lower-severity                   | Higher-severity | OR (95% CI)          | p*     | OR (95% CI)           | p*    |
| Gender                |                                  |                 |                      |        |                       |       |
| Female                | 12 (13.8)                        | 75 (86.2)       | 3.571 (1.236-10.320) | 0.019  | 4.046 (1.142- 14.334) | 0.030 |
| Male                  | 8 (36.4)                         | 14 (63.6)       | Reference Category   |        | Reference Category    |       |
| Age                   | 14.56±1.72                       | 15.04±1.56      | 1.207 (0.891-1.635)  | 0.224  | 1.356 (0.948- 1.941)  | 0.096 |
| Total SRS Score       | 76.90±20.77                      | 97.35±30.33     | 1.024 (1.006-1.042)  | 0.008  | 1.020 (0.998- 1.043)  | 0.076 |
| AQ-Father Total Score | 22.05±4.55                       | 16.62±4.70      | 0.803 (0.716-0.900)  | <0.001 | 0.810 (0.709-0.924)   | 0.002 |

\*: Binary Logistic Regression Analysis (Enter Method), Cox&Snell  $R^2=0.227$ , Nagelkerke  $R^2=0.370$ , Hosmer and Lemeshow Chi Square=5.365,  $p=0.718$ , Variable(s) entered on step 1: gender, Age, Total SRS Score, AQ-Father Total Score, **SRS**: Social Responsiveness Scale, **AQ**: Autism Spectrum Quotient, **OR**: Odds Ratio, **95% CI**: 95% Confidence Interval

**Table VI: Relationship between participants' SRS scores and parents' AQ scores**

|                          | Total SRS Score      | p     |
|--------------------------|----------------------|-------|
| Mother*                  |                      |       |
| Lower autistic traits    | 99.00 (66.00-122.00) | 0.125 |
| Elevated autistic traits | 74.50 (61.00-91.00)  |       |
| Father*                  |                      |       |
| Lower autistic traits    | 99.50 (71.00-122.00) | 0.017 |
| Elevated autistic traits | 63.00 (55.00-91.00)  |       |

\*: median (IQR) (Mann-Whitney U test), **SRS**: Social Responsiveness Scale, **AQ**: Autism Spectrum Quotient, **Note**: Participants were categorized into "lower" and "elevated" autistic trait groups based on a cutoff score of 26 on the Autism Spectrum Quotient (Ashwood et al. 2016).

development and maintenance of social anxiety symptoms (5). In this context, increased parental expectations may contribute to greater performance-related pressure, which in turn may exacerbate social anxiety severity in adolescents. Another potential explanation relates to parental sensitivity to social cues. Parents with lower autistic traits may be more attuned to subtle social signals and evaluation, which could inadvertently model or reinforce heightened vigilance toward social judgment in adolescents. Previous research suggests that parental characteristics, including anxiety-related tendencies and social processing styles, can influence children's emotional development and fear responses, which may contribute to the amplification of anxiety-related cognitive biases (14). Additionally, family-level environmental factors may play a role, as environments characterized by heightened emphasis on social evaluation and performance have been implicated in the development and maintenance of social anxiety (5). This finding contrasts with prior literature suggesting that the broader autism phenotype confers genetic vulnerability to autistic traits and related social difficulties, highlighting the need for cautious interpretation and further investigation (12,13). These interpretations remain speculative and should be examined in future studies, as topic is rarely addressed in existing research.

One plausible explanation relates to reporting and perceptual differences. Previous research has demonstrated discrepancies between self- and informant-reported BAP traits, particularly among fathers with elevated autistic characteristics (16). Fathers with higher BAP traits may differ in their perception or interpretation of social behaviors, potentially influencing questionnaire-based assessments, a phenomenon that has been described as a possible "blind spot" effect in prior research (16). Such informant-related

biases may also influence the assessment of adolescents' social responsiveness when parental reports are used and should therefore be considered when interpreting SRS-based findings.

Importantly, findings derived from the SRS should also be interpreted with caution. Due to the lack of normative Turkish adolescent data and the use of raw scores, SRS results in this study do not provide diagnostic or norm-referenced information regarding autistic traits, but rather reflect relative variation in social functioning within the sample. Furthermore, because both SRS and AQ were completed by the same informants, shared-informant bias may have influenced the observed associations. As the specific informant for the SRS was not systematically recorded, the potential impact of shared-informant bias could not be fully evaluated. Therefore, SRS findings should not be interpreted as independent evidence of autistic traits but rather as exploratory indicators of social functioning.

It is also possible that associations between parental AQ scores and adolescent social anxiety differ across specific AQ subdomains. The AQ total score encompasses heterogeneous dimensions, some of which may relate differently to anxiety-related processes, reflecting the heterogeneous nature of BAP traits (12). However, these interpretations remain speculative, as subscale-level mechanisms were not directly examined in the present study. Given the number of statistical comparisons conducted, particularly in subscale analyses, the risk of Type I error should be considered when interpreting these findings.

Analyses examining the association between adolescents' autistic traits and parental AQ scores were pre-specified, although they were secondary to the primary aim of investigating social anxiety and parental BAP characteristics. Maternal AQ scores were not associated with adolescents' social responsiveness, whereas higher paternal AQ scores were linked to fewer social responsiveness difficulties.

While most studies report positive associations between parental BAP traits and children's social difficulties previous research suggests that fathers may underreport BAP traits in self-report measures, leading to discrepancies between self- and informant-based assessments (11,13,15,16,28). The inverse association observed in the present study may therefore reflect measurement-related, perceptual, or contextual factors rather than a direct protective influence of paternal autistic traits. The relatively weak correlation coefficients alongside

statistically significant group differences, may partly reflect the impact of categorizing continuous variables, which can accentuate contrasts between subgroups. Accordingly, group-based findings should be interpreted as exploratory and supplementary rather than primary evidence, and greater emphasis should be placed on dimensional analyses.

Importantly, the separate examination of maternal and paternal BAP traits provides a more nuanced understanding of familial influences on adolescent social anxiety and may inform future family-based research and intervention approaches. Accordingly, the observed associations require replication in independent samples using multi-informant and longitudinal designs. Prospective and multi-informant designs incorporating self-report, informant-based measures, and direct observation of father–child interactions are needed to clarify directionality and underlying mechanisms.

The absence of a non-clinical control group also limits the interpretability of the findings. Specifically, it was not possible to determine whether parental AQ scores or adolescent SRS scores differed from population norms, nor whether the observed associations are specific to social anxiety disorder or reflect broader transdiagnostic processes.

## Conclusion

The present findings suggest that adolescent SAD severity is associated not only with individual psychological factors but also with familial characteristics, particularly parental traits. However, these associations should be interpreted cautiously and considered exploratory. The observed associations between paternal AQ scores and adolescent social anxiety should not be considered evidence of protective or causal effects. Importantly, these findings highlight that examining maternal and paternal BAP traits separately provides a more nuanced understanding of familial influences on adolescent social anxiety.

## Limitations

Several limitations should be acknowledged. The modest sample size, cross-sectional design, and reliance on parental self-report measures limit causal inference. Despite the high post-hoc power estimates, the relatively small size of the low-severity group may have affected the stability of subgroup comparisons. The relatively low rate of comorbid psychiatric disorders in the present sample may reflect strict diagnostic procedures, sample characteristics, or exclusion criteria.

In addition, the absence of age- and gender-normed Turkish reference data for the SRS and the use of raw scores limit interpretability beyond within-sample associations; therefore, SRS findings should be considered exploratory. Additionally, the specific informant for the SRS was not systematically recorded, which limited the ability to fully evaluate the impact of shared-informant bias. The absence of a non-clinical control group also limits interpretation of autistic trait levels relative to the general population. Specifically, it was not possible to determine whether parental AQ scores or adolescent SRS scores differed from population norms, nor whether the observed associations are specific to social anxiety disorder or reflect broader transdiagnostic processes. Accordingly, the findings should be interpreted

as reflecting within-sample variability rather than deviations from normative functioning. Additionally, the inclusion criterion requiring participation of both parents may have introduced selection bias and may limit generalizability, as families with absent or non-participating fathers were not represented.

Accordingly, these findings require replication in independent samples using longitudinal and multi-informant designs. Future studies should employ longitudinal and multi-informant designs and incorporate observational methods to better elucidate parent–child dynamics and clarify the directionality of these associations.

## Ethics committee approval

This study was conducted in accordance with the Helsinki Declaration Principles. The study was approved by Ankara Bilkent City Hospital (10/01/2024, reference number: E2-24-6099).

## Contribution of the authors

Study conception and design: SBU, ME, NY; data collection: SBU, ME; analysis and interpretation of results: SBU, NY, ME, TMB; draft manuscript preparation: SBU, NY, ME, TMB. All authors reviewed the results and approved the final version of the manuscript.

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## Conflict of interest

The authors declare that there is no conflict of interest.

## References

1. American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 5th ed. Arlington (VA): American Psychiatric Publishing; 2013. <https://doi.org/10.1176/appi.books.9780890425596>
2. Pickard H, Hirsch C, Simonoff E, Happé F. Exploring the cognitive, emotional and sensory correlates of social anxiety in autistic and neurotypical adolescents. *J Child Psychol Psychiatry*. 2020;61:1317–27. <https://doi.org/10.1111/jcpp.13214>
3. van Steensel FJ, Heeman EJ. Anxiety levels in children with autism spectrum disorder: A meta-analysis. *J Child Fam Stud*. 2017;26:1753–67. <https://doi.org/10.1007/s10826-017-0687-7>
4. Spain D, Sin J, Linder KB, McMahon J, Happé F. Social anxiety in autism spectrum disorder: A systematic review. *Res Autism Spectr Disord*. 2018;52:51–68. <https://doi.org/10.1016/j.rasd.2018.04.007>
5. Spence SH, Rapee RM. The etiology of social anxiety disorder: An evidence-based model. *Behav Res Ther*. 2016;86:50–67. <https://doi.org/10.1016/j.brat.2016.06.007>
6. Bejerot S, Eriksson JM, Mörtberg E. Social anxiety in adult autism spectrum disorder. *Psychiatry Res*. 2014;220(1–2):705–7. <https://doi.org/10.1016/j.psychres.2014.08.030>
7. Puleo CM, Kendall PC. Anxiety disorders in typically developing youth: Autism spectrum symptoms as a predictor of cognitive-behavioral treatment. *J Autism Dev Disord*. 2011;41(3):275–86. <https://doi.org/10.1007/s10803-010-1047-2>
8. Dickter CL, Chang I, Burk JA, Bravo AJ. Autistic traits, emotion regulation, social anxiety, drinking to cope, and problematic alcohol use: A cross-cultural examination among young adults from seven countries. *Subst Use Misuse*. 2025;60(5):766–74. <https://doi.org/10.1080/10826084.2024.2447435>
9. Colvert E, Tick B, McEwen F, Stewart C, Curran SR, Woodhouse E, et al. Heritability of autism spectrum disorder in a UK population-

- based twin sample. *JAMA Psychiatry*. 2015;72(5):415-23. <https://doi.org/10.1001/jamapsychiatry.2014.3028>
10. Robinson EB, St Pourcain B, Anttila V, Kosmicki JA, Bulik-Sullivan B, Grove J, et al. Genetic risk for autism spectrum disorders and neuropsychiatric variation in the general population. *Nat Genet*. 2016;48(5):552-55. <https://doi.org/10.1038/ng.3529>
  11. Sasson NJ, Lam KS, Parlier M, et al. Autism and the broad autism phenotype: Familial patterns and intergenerational transmission. *J Neurodev Disord*. 2013;5:11. <https://doi.org/10.1186/1866-1955-5-11>
  12. Bora E, Aydın A, Saraç T, Kadak MT, Köse S. Heterogeneity of subclinical autistic traits among parents of children with autism spectrum disorder: Identifying the broader autism phenotype with a data-driven method. *Autism Res*. 2017;10(2):321-6. <https://doi.org/10.1002/aur.1661>
  13. Loncarevic A, Maybery MT, Barbaro J, et al. Parent-child interactions may help to explain relations between parent characteristics and clinically observed child autistic behaviours. *J Autism Dev Disord*. 2024;54(7):2742-56. <https://doi.org/10.1007/s10803-023-05914-x>
  14. Aktar E, Majdandžić M, De Vente W, Bögels SM. Parental social anxiety disorder prospectively predicts toddlers' fear/avoidance in a social referencing paradigm. *J Child Psychol Psychiatry*. 2014;55(1):77-87. <https://doi.org/10.1111/jcpp.12121>
  15. Shi LJ, Ou JJ, Gong JB, Wang SH, Zhou YY, Zhu FR, et al. Broad autism phenotype features of Chinese parents with autistic children and their associations with severity of social impairment in probands. *BMC Psychiatry*. 2015;15:168. <https://doi.org/10.1186/s12888-015-0568-9>
  16. Sasson NJ, Faso DJ, Parlier M, Daniels JL, Piven J. When father doesn't know best: Selective disagreement between self-report and informant report of the broad autism phenotype in parents of a child with autism. *Autism Res*. 2014;7(6):731-9. <https://doi.org/10.1002/aur.1425>
  17. Ünal F, Öktem F, Çetin Çuhadaroglu F, et al. Reliability and validity of the Schedule for Affective Disorders and Schizophrenia for School-Age Children-Present and Lifetime version, DSM-5 November 2016-Turkish adaptation (K-SADS-PL-DSM-5-T). *Türk Psikiyatri Derg*. 2019;30(1):52-61. <https://doi.org/10.5080/u23408>
  18. American Psychiatric Association. Severity measure for social anxiety disorder (social phobia): Child age 11-17 [Internet]. 2013 [cited 2025 Jul 1]. Available from: <http://www.psychiatry.org/practice/dsm/dsm5/online-assessment-measures>
  19. Yalın Sapmaz Ş, Ergin D, Şen Celasin N, et al. Validity and reliability of the Turkish version of DSM-5 social anxiety disorder severity scale-Child form. *Noropsikiyatri Arsivi*. 2017;54(4):354-7. <https://doi.org/10.5152/npa.2017.17027>
  20. Constantino JN, Davis SA, Todd RD, Schindler MK, Gross MM, Brophy SL, et al. Validation of a brief quantitative measure of autistic traits: Comparison of the Social Responsiveness Scale with the Autism Diagnostic Interview-Revised. *J Autism Dev Disord*. 2003;33(4):427-33. <https://doi.org/10.1023/A:1025014929212>
  21. Ünal S, Güler A, Dedeoğlu C. Social reciprocity in a clinical sample diagnosed with attention-deficit/hyperactivity disorder: Comparison with a school sample [poster]. 19th National Congress of Child and Adolescent Mental Health and Disorders; 2009 Apr; Antalya, Turkey.
  22. Kalayci BM, Nalbant K, Akdemir D. Autistic traits and social responsiveness: The relationship between autistic traits and comorbid psychiatric symptoms in adolescents with anorexia nervosa. *Arch Neuropsychiatry*. 2021;58(4):283. <https://doi.org/10.29399/npa.27175>
  23. Baron-Cohen S, Wheelwright S, Skinner R, Martin J, Clubley E. The autism-spectrum quotient (AQ): Evidence from Asperger syndrome/high-functioning autism, males and females, scientists and mathematicians. *J Autism Dev Disord*. 2001;31(1):5-17. <https://doi.org/10.1023/A:1005653411471>
  24. Köse S, Bora E, Erermiş S, Aydın C. Psychometric features of Turkish version of Autism-Spectrum Quotient. *Anadolu Psikiyatri Derg*. 2009;11(3):253-60.
  25. Ashwood KL, et al. Predicting the diagnosis of autism in adults using the Autism-Spectrum Quotient (AQ) questionnaire. *Psychological medicine*. 2016;46(12): 2595-604. <https://doi.org/10.1017/S0033291716001082>
  26. Kaufman J, Birmaher B, Axelson D, et al. Schedule for Affective Disorders and Schizophrenia for School-Aged Children: Present and Lifetime Version (K-SADS-PL), DSM-5 November 2016 Working Draft. New Haven (CT): Yale University; 2016.
  27. Cohen J. Statistical power analysis for the behavioral sciences. 2<sup>nd</sup> ed. Hillsdale (NJ): Lawrence Erlbaum Associates; 1988.
  28. Maxwell CR, Parish-Morris J, Hsin O, et al. The broad autism phenotype predicts child functioning in autism spectrum disorders. *J Neurodev Disord*. 2013;5:25. <https://doi.org/10.1186/1866-1955-5-25>