The role of anger rumination and autism spectrum disorder–linked perseveration in the experience of aggression in the general population

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Abstract

This study (a) examined the role of anger rumination as a mediator of the relation between social anxiety and the experience of anger, hostility, and aggression, in the general population, and (b) evaluated the degree to which the presence of autism spectrum disorder characteristics moderates the indirect influence of anger rumination. We then explored whether social cognition and perseveration characteristic of autism spectrum disorder uniquely accounted for the predicted moderation. In this survey study of young adults ($n = 948$), anger rumination mediated the relation between social anxiety and hostility, as well as verbal and physical aggression, as predicted. Greater autism spectrum disorder characteristics augmented the effect of social anxiety on hostility and physical aggression by increasing the effect of anger rumination, but not by increasing the effect of social anxiety on anger rumination. Implications for developing treatment approaches that target hostility and aggression among young adults who may not be formally diagnosed but have characteristics of autism spectrum disorder are discussed.

Keywords

aggression; anger; autism; hostility; social anxiety; young adults

Congruent with the conceptualization of autism spectrum disorder (ASD) as residing along a spectrum, symptoms and characteristics associated with ASD are present in the general population (Baron-Cohen et al., 2001; Constantino and Todd, 2003, 2005; Hoekstra et al., 2007; Wainer et al., 2011). Characteristics of ASD in neurotypical adults have been associated with increased risk of psychiatric and psychosocial problems (Jobe and White, 2007), reduced gaze reciprocity (Chen and Yoon, 2011), reduced social skills, and poorer performance on social cognitive-affective processing and theory of mind abilities (Sasson et al., 2013), as well as executive functioning difficulties ranging from inflexibility in problem solving to inappropriate modulation of emotional responses (Christ et al., 2010). This

growing body of research highlights the importance of studying ASD characteristics continuously among non-clinical samples, to inform our understanding of specific facets of the ASD phenotype and to better understand potential co-occurring problems. The use of nonclinical samples facilitates our ability to identify potentially clinically relevant processes and also allows for sufficient statistical power to detect small, yet meaningful, effects. The purpose of this study was to explore mechanisms that may mediate the relation between social anxiety and the experience of anger, hostility, and aggression and to evaluate the degree to which the presence of ASD characteristics moderates the influence of such mechanisms.

The social deficits seen in people with ASD include problems with social pragmatics and reciprocity, joining conversations, recognizing viewpoints of others, and understanding and expressing emotions (Bellini, 2004). Owing to these social deficits, youth with ASD are not as socially integrated, are less well accepted, and have fewer reciprocal friendships compared to typically developing peers (Chamberlain et al., 2007). Cognitively able individuals are often aware of their inability to meet social demands although they place as much emphasis on the importance of peer approval as typically developing peers (Williamson et al., 2008). This awareness is hypothesized to contribute to the development of secondary social anxiety and heightened fear of negative peer evaluation (White and Roberson-Nay, 2009), and social anxiety is one of the most frequently reported problems in individuals with ASD (Kuusikko et al., 2008; Van Steensel et al., 2011). While this research has been conducted with school-aged children and adolescents, it is plausible that similar processes operate in adults with ASD (see White et al., 2011). Studies of community samples of adolescents and adults with ASD have provided estimates of social anxiety within the range of 29.2%–34.2% (Kreiser and White, 2014). Additionally, some individuals with ASD demonstrate a threat-related perceptual bias to social stimuli (Kuusikko et al., 2009), similar to the biases evident in individuals with social phobia. In a study examining emotion recognition abilities, Kuusikko et al. reported that youth with ASD, compared to typically developing peers, were more likely to perceive ambiguous faces as portraying negative emotions, suggesting that individuals with ASD may have biased interpretations and anticipate negative responses from others. Collectively, this research suggests that social anxiety is common in ASD and, when present, confers risk for the development of other problems. Thus, it is important to identify predictors of behaviors and mechanisms that underlie emotional and behavioral difficulties seen in people with ASD (Lerner et al., 2012).

Socially anxious individuals have traditionally been described as behaviorally inhibited, over-regulated, and risk-averse in situations that elicit perceived negative evaluations (e.g. Beidel and Turner, 2007). Similar to typically developing children, some adolescents with ASD develop anxious or depressive symptoms in response to social evaluative anxiety (Parkhurst and Asher, 1992). Others may become angry as a result of social stressors they encounter (Attwood, 2007; Tantam, 2003). Indeed, social anxiety has been associated with the experience and expression of anger in typically developing adults (Kachin et al., 2001; Kashdan et al., 2009). The perception of rejection from significant others may lead to hostile or aggressive responses (Leary et al., 2006). Among children with ASD, aggression has been cited as a frequent problem (Farmer and Aman, 2011; McCracken et al., 2002; Storch et al., 2012), and evidence indicates that, similar to neurotypical samples (e.g. Kashdan et al.,

2009), social anxiety and facets of aggression co-occur (Farrugia and Hudson, 2006; Green et al., 2000; Meyer et al., 2006). Social anxiety is related to aggressive behavior in children and adolescents with ASD in a curvilinear fashion, such that too much or too little social anxiety predicts more aggression (Pugliese et al., 2013). Although such research has been conducted with youth with ASD, it is plausible that similar mechanisms are present in adult samples. For example, characteristics of ASD are positively associated with symptoms of social anxiety, aggression, and hostility in analogue samples using college students (White et al., 2011). Among individuals with ASD, chronic vigilance to sources of potential negative evaluation may predispose some socially anxious individuals to perceive hostility from others and display hostile feelings in return (White et al., 2012). The mechanisms for such an association, however, need to be more thoroughly investigated.

A growing body of research indicates that social anxiety is associated with the experience of anger and anger expression in adults without ASD (Kashdan et al., 2009). Rumination is defined as a pattern of responding to distress with perseverative thinking about the causes or consequences related to that distress, at the expense of using problem-solving techniques to improve one's mood (Nolen-Hoeksema and Morrow, 1991). Anger rumination, a maladaptive emotion regulation process described as "the unintentional and recurrent cognitive processes that occur during and persist after an episode of anger experience" (Sukhodolsky et al., 2001: 690), may serve as the pathway for sustaining and augmenting anger. It has been proposed that anger rumination depletes self-regulatory resources, leading to reduced behavioral inhibition (Kashdan et al., 2009). Thus, a heightened perception of social threat (i.e. social anxiety) could lead to anger rumination, which in turn could lead to hostility or behavioral expressions of anger.

Based largely on descriptive and cross-sectional research, it appears that people with ASD display more problems with anxiety, emotional lability, and anger than people without ASD (Mazefsky et al., 2012; White et al., 2009). Given the myriad of behaviors that comprise ASD, identifying specific characteristics that moderate the relation between social anxiety and aggression is particularly important. Perseveration, the inability to disengage attention from or inhibit responding to a stimulus that has become irrelevant, may play an important role in the maintenance of negative emotion regulation strategies, such as anger rumination. Several studies have documented impairments with cognitive flexibility and the ability to shift attentional focus in individuals with ASD (Hill, 2008; Ozonoff et al., 2004; Rinehart et al., 2001). Mazefsky et al. (2012) discussed the effect cognitive inflexibility may have on emotional processes by proposing that individuals with ASD hyper-focus on distressing stimuli and have difficulty shifting away from a negative emotion. In fact, recent research has demonstrated that adults with ASD engage in higher levels of ruminative self-focus than their typically developing peers (Crane et al., 2013) and that rumination is linked to insistence on sameness characteristic of ASD (Gotham et al., 2014). Thus, when anger rumination is the chosen emotion regulation strategy, individuals with high ASD traits may have more difficulty disengaging from this process. We believe that high levels of cognitive perseveration would intensify the relationships in the model described above.

This study

We tested the above models in a large sample of undergraduate students who responded to questionnaires assessing our constructs of interest. Our first hypothesis for this study was that social anxiety leads to hostility and aggression through anger rumination, after controlling for the effects of gender and grade point average (GPA). Our second hypothesis was that overall ASD characteristics would augment the influence of social anxiety through moderation of the mediated pathways (social anxiety to anger rumination and anger rumination to hostility or aggression). An additional aim was to determine whether either gender or GPA would also moderate these effects.

Finally, an exploratory analysis was conducted to examine how specific characteristics associated with ASD (i.e. autism spectrum quotient (AQ) items) moderate the hypothesized mediating influence of anger rumination on the relation between social anxiety and verbal and physical aggression. Deconstructing the diagnosis into its component symptoms and features may promote identification of specific characteristics that are central to, or potent predictors of, aggression. That is, the presence of specific traits associated with ASD, namely, misinterpretation of social information and perseverative thinking or a lack of flexibility, may be what drives the hypothesized moderation. For the relation between social anxiety and anger rumination, we hypothesized that social difficulty associated with ASD would moderate the relation such that greater social difficulty predicts greater anger rumination. For the relation between anger rumination and aggression, we hypothesized that perseverative thought patterns would moderate the relation such that greater difficulty disengaging from perseverative thought patterns predicts greater hostility (e.g. Mazefsky et al., 2012).

Method

Procedures

This study was approved by the university's Institutional Review Board. Participants were recruited through an electronic experiment database and flyers posted on campus. After providing informed consent, participants completed online questionnaires about social anxiety, anger rumination, aggression, and characteristics of ASD.

Participants

Participants were undergraduate students enrolled in a public university in the United States. Of the full sample ($n = 1003$) enrolling in the study, 948 students completed all measures; descriptive statistics for these cases are shown in Table 1, and correlations between study variables are shown in Table 2. The participants with complete data were predominantly female (73.5%) and tended to be in their first (38.9%), second (24.2%), or third (23.1%) year of college. Participants identified themselves as Caucasian (81.3%), Asian/Asian American (9.5%), African/African American (3.9%), Bi-racial or Multiracial (3.3%), Other (1.2%), American Indian or Alaskan Native (0.6%), and Native Hawaiian-Pacific Islander (0.2%). In regard to ethnicity, 3.3% identified themselves as Hispanic, Latino/a, and Chicano/a.

Measures

Social Interaction Anxiety Scale (SIAS)—Composed of 20 items, the SIAS (Mattick and Clarke, 1998) measures anxiety in social interaction situations, with items rated on a 5-point scale from 0 ("not at all characteristic of me") to 4 ("extremely characteristic of me"), with higher scores indicating greater social anxiety. The SIAS has demonstrated high internal consistency ($a = 0.92$ in the current sample) and test–retest reliability ($r = 0.86$; Orsillo, 2001).

Anger Rumination Scale (ARS)—The ARS (Sukhodolsky et al., 2001) examines the degree to which individuals tend to focus on angry moods, speculate about causes or consequences of angry moods, or recall past episodes of anger. Individuals are asked to rate their tendency toward anger rumination on nineteen 4-point scale items, with higher scores indicating greater anger rumination. The ARS has demonstrated high internal consistency ($a = 0.94$ in the current sample) and good test–retest reliability ($r = 0.77$; Sukhodolsky et al., 2001).

Buss and Perry Aggression Questionnaire (BPAQ)—The BPAQ (Buss and Perry, 1992) is a 29-item self-report questionnaire that measures trait aggression on a 1-point ("extremely uncharacteristic") to 5-point ("extremely characteristic") scale, with higher scores indicating more aggression. The BPAQ has four subscales assessing physical aggression (BPAQ-Physical), verbal aggression (BPAQ-Verbal), anger (BPAQ-Anger), and hostility (BPAQ-Hostility). Given the overlap in constructs between anger and anger rumination, the anger subscale was not used as an outcome measure. Internal consistency of the subscales ranges from $a = 0.83$ to 0.87 in the current sample.

AQ—A self-report measure of characteristics associated with ASD, the AQ (Baron-Cohen et al., 2001) has 50 items, with higher scores indicating a greater degree of characteristics associated with ASD. Previous studies have reported good test–retest reliability and acceptable internal consistency in adult samples for the total AQ score (Baron-Cohen et al., 2001; $a = 0.77$ for the current sample). For the purposes of this study, the AQ was scored according to the 4-point responses to yield a dimensional index of ASD severity (range: 0–200; Austin, 2005). Of the total sample, 1.05% met clinical cut-off on the AQ.

Six items from the AQ were selected to be examined individually in the exploratory analyses based upon the content of the items, not on how the items related to each other or the total AQ score. Four of these items were selected because they directly addressed social difficulty related to ASD: AQ35—I am often the last to understand the point of a joke, AQ36—I find it easy to work out what someone is thinking or feeling just by looking at their face, AQ42—I find it difficult to imagine what it would be like to be someone else, and AQ45—I find it difficult to work out people's intentions. The other two items were selected because they directly addressed perseverative thought patterns related to ASD: AQ4—I frequently get so strongly absorbed in one thing that I lose sight of other things and AQ39—People often tell me that I keep going on and on about the same thing.

Statistical analyses

Analyses were conducted using Mplus (Muthén and Muthén, 2014). Full information maximum likelihood (FIML), recommended by Enders (2010) as a state-of-the-art method for dealing with missing data, was used. Unlike listwise deletion, FIML uses information from incomplete cases. The use of FIML permitted the inclusion of 967 cases for the first mediation model and 948 cases for the mediation models that included moderators. All continuous predictors and mediators were grand-mean centered for the moderation analyses to improve interpretability of the path coefficients as recommended by Cohen et al. (2003), who also recommend not centering dichotomous variables (i.e. gender) or continuous outcome variables (i.e. the BPAQ variables).

To test the first hypothesis, ARS was regressed on SIAS, GPA, and gender, which was coded 0 for females and 1 for males, while BPAQ-Hostility, BPAQ-Verbal, and BPAQ-Physical were regressed on ARS, SIAS, GPA, and gender. To test the second hypothesis, ARS was regressed on SIAS, AQ, GPA, and gender, as well as the five two-way interactions: SIAS by AQ, SIAS by GPA, SIAS by gender, AQ by GPA, and AQ by gender. At the same time, the three BPAQ variables were regressed on SIAS, ARS, AQ, gender, and GPA, as well as the five two-way interaction terms: ARS by AQ, ARS by GPA, ARS by gender, AQ by gender, and AQ by GPA (Fairchild and MacKinnon, 2009; Preacher et al., 2007). For the exploratory models, the total AQ score was replaced by the specific AQ questions and the appropriate interaction terms, while gender and GPA were included as control variables. For all models, the BPAQ variables were allowed to correlate. For each specific mediated effect, 95% confidence intervals were computed using the percentile bootstrap procedure (Fritz et al., 2012), such that if a confidence interval contained zero, the mediated effect was not statistically significant, and if the confidence interval did not contain zero, the mediated effect was statistically significant.

Results

As shown in Figure 1, SIAS had a positive effect on ARS and ARS had positive effects on the three BPAQ variables, when controlling for SIAS, gender, and GPA, such that increases in ARS are related to increases in all three BPAQ variables. The specific mediated effect for each of the BPAQ variables is equal to the product of the path coefficient between SIAS and ARS, and the path coefficient between ARS and the respective BPAQ variable, and represents the mediated effect of SIAS on the specific BPAQ variable through ARS, independent of the mediated effect for either of the other BPAQ variables. The specific mediated effects, the 95% percentile bootstrap confidence intervals, and the absolute value of the ratio of the specific mediated effect to the direct effect (a measure of effect size that represents the magnitude of the mediated effect compared to the direct effect; MacKinnon, 2008) for the mediated effects on BPAQ-Hostility, BPAQ-Physical, and BPAQ-Verbal were 0.093 (0.074, 0.115) $ES = 0.744$, 0.068 (0.052, 0.087) $ES = 3.10$, and 0.055 (0.042, 0.070) $ES = 1.45$, respectively. This supports the hypothesis that ARS mediates the relation between SIAS and the BPAQ variables. In addition, gender was a significant predictor of all three BPAQ variables, though not ARS; the positive sign of all three parameter estimates indicates being male predicts higher scores on all three BPAQ variables. GPA was a

significant predictor of only BPAQ-Physical, in which the negative effect means that higher GPA values predicted lower scores for physical violence.

As shown in Figure 2, total AQ did not moderate the effect of SIAS on ARS but did moderate the relations between ARS, BPAQ-Hostility, and BPAQ-Physical. Positive coefficients indicate that higher scores on AQ increased the magnitude of the effect of ARS on BPAQ-Hostility and BPAQ-Physical. This means that higher scores on the AQ are associated with an increase in the effect of SIAS on these two BPAQ variables by increasing the effect of ARS on the outcome variables (but not by increasing the effect of SIAS on ARS). None of the interaction terms containing gender or GPA were statistically significant. These results support the hypothesis that total AQ moderates some of the relations between ARS and BPAQ, but did not show total AQ score to moderate the relation between SIAS and ARS.

When examining moderation effects, the noninteraction term path coefficients represent the relation between two variables when all other predictor variables are equal to zero (Cohen et al., 2003). Hence, the coefficient for the path between SIAS and ARS and the coefficients for the paths between ARS and each of the three BPAQ variables represent the effects for females (i.e. gender = 0) with the mean total AQ score for the sample, 106.85, and the mean GPA score for the sample, 3.10. The specific mediated effects, 95% percentile bootstrap confidence intervals, and ratio of the mediated effect to the direct effect for the specific mediated effects on BPAQ-Hostility, BPAQ-Physical, and BPAQ-Verbal were 0.071 (0.050, 0.096) $ES = 0.72$, 0.048 (0.32, 0.066) $ES = 1.00$, and 0.043 (0.030, 0.058) $ES = 0.93$, respectively. Mediated effects for other values of total AQ were not estimated because the mediated effect would also be significant for individuals with total AQ scores higher than the sample mean, while lower AQ scores were not considered since the mean score was already below threshold for an ASD diagnosis. Estimating mediated effects for males and other values of GPA was unnecessary because the interactions including gender and GPA were not statistically significant.

In testing item-level moderation, none of the social difficulty items (i.e. AQ35, AQ36, AQ42, and AQ45) moderated the relation between SIAS and ARS. For perseverative thought pattern, one variable, AQ39 (people often tell me that I keep going on and on about the same thing), moderated the relation between ARS, BPAQ-Hostility ($b = 0.050$, standard error (SE) $= 0.013$, $p < 0.001$), and BPAQ-Verbal ($b = 0.041$, $SE = 0.011$, $p = 0.001$). The positive coefficients indicate that higher scores on AQ39 increased the positive relation between ARS and the two BPAQ items.

A second item-level model was estimated to examine possible path-specific moderators; the perseveration items (i.e. AQ4 and AQ39) were examined as moderators of the relation between SIAS and ARS, and two of the social difficulty items (i.e. AQ42 and AQ45) as moderators of the relation between ARS and the BPAQ variables. No items moderated the relation between SIAS and ARS, but AQ45 (I find it difficult to work out people's intentions) did moderate the relation between ARS and BPAQ-Hostility ($b = 0.053$, $SE = 0.015$, $p < 0.001$), indicating that higher scores on this item strengthened the relation between ARS and BPAQ-Hostility.

When both AQ39 and AQ45 were included as moderators of the relation between ARS and the BPAQ variables, AQ39 was still a moderator of BPAQ-Hostility ($b = 0.040$, $SE = 0.014$, $p = 0.004$) and BPAQ-Verbal ($b = 0.038$, $SE = 0.011$, $p = 0.001$), and AQ45 still moderated BPAQ-Hostility ($b = 0.038$, $SE = 0.016$, $p = 0.016$).

Discussion

We sought to determine whether anger rumination mediates the influence of social anxiety and the experience of hostility and aggression in healthy adults and, secondarily, to determine whether specific ASD traits augmented these relationships. Consistent with research indicating that among socially anxious people, those who are more cognitively rigid tend to experience more aggression (Kashdan et al., 2009), our first hypothesis was supported. Specifically, social anxiety predicted anger rumination, and subsequently, greater anger rumination was associated with more hostility, verbal aggression, and physical aggression. Muraven and Baumeister (2000) proposed that self-control can be conceptualized as finite and, when depleted by excessive self-focus and worry about negative evaluation, there are decreased self-regulation resources available. Anger rumination may act similarly by depleting one's store of self-regulatory resources used to control and prevent socially undesirable behaviors, making them more vulnerable to succumb to hostility or aggressive behavior (Kashdan et al., 2009).

Our second hypothesis specifically focused on whether characteristics of ASD (i.e. total AQ score) augment this relation. While characteristics of ASD were associated with anger rumination, they did not moderate the relation between social anxiety and anger rumination. ASD characteristics did moderate the relation between anger rumination and physical aggression, as well as hostility, but not verbal aggression. In other words, total ASD characteristics increased the effect of social anxiety indirectly by increasing the effect of anger rumination on hostility and physical aggression. Consistent with Mazefsky et al.'s (2012) proposed model, it is plausible that cognitive perseveration associated with characteristics of ASD may confer a greater risk to engage in anger rumination, which may turn into hostility or physical aggression. In sum, social anxiety had a greater indirect effect on aggression and hostility for those with more characteristics of ASD, measured dimensionally, in the current sample.

Our exploratory analyses aimed to determine which specific ASD characteristics uniquely account for the predicted moderation. The perseverative domain item people tell me that I keep going on and on about the same thing moderated the effect of anger rumination on hostility and verbal aggression, while the social domain item I find it difficult to work out people's intentions moderated the effect of anger rumination on hostility. When both of these items were considered simultaneously, both moderated the effect. It is possible that reduced ability to infer cues of boredom in conversation partners may lead to increased real or perceived social rejection due to an inability to maintain a reciprocal social interaction. In this scenario, an individual might ruminate angrily on social rejection or engage in counterfactual thoughts relating to social judgment, leading to hostile thoughts or even verbal confrontation. Alternatively, criticism regarding one's engagement in monologue speech in the absence of the ability to understand why others are not interested may be the

cause to recollect and ruminate on previous social failures, leading to hostility or a verbal altercation. We found no evidence, however, that social impairment moderated the relation between social anxiety and anger rumination.

To the authors' knowledge, there exists no research evaluating a mechanistic model of social anxiety, anger, and ASD traits. There were limitations, however, which indicate the need for caution when generalizing these results. Although mediation was statistically supported in this study, the cross-sectional nature of the study prohibits a true test of mediation. Measuring variables of interest longitudinally to determine causal processes would strengthen results. Additionally, we conducted analyses to determine whether specific facets of ASD moderated our hypothesized relationships using individual items from the AQ. Although such an approach is warranted given the exploratory and preliminary nature of this study, future research should consider more psychometrically defined scales to explore these relationships. Finally, the sample used in this study was a sample of convenience and, as such, had proportionally more females than is likely if a clinical sample of adults with ASD were used. While we sought to overcome this limitation by testing the moderating influence of sex, it remains a limitation. While these results may apply to young adults with diagnosed ASD, the nature of the current sample precludes generalization to clinical samples. Future research with clinical samples is necessary to determine the nature of any relationship between social anxiety and aggression.

Conclusion

In conclusion, anger rumination mediates the influence of social anxiety on hostility, verbal aggression, and physical aggression. Additionally, the presence of ASD traits may increase the effect of social anxiety on hostility and physical aggression indirectly by increasing the effect of anger rumination on these two outcome variables. This research seeks to explain why social anxiety may lead to hostility or aggression in some individuals. There is no evidence that characteristics of ASD increase risk of violent behavior. In fact, there is more evidence that any heightened risk of violence is attributable to co-occurring psychiatric problems than directly to ASD (Newman and Ghaziuddin, 2008). Cognitive styles commonly seen in ASD, however, may exacerbate the influence of social anxiety on problems with hostility and aggression. As more research is conducted on co-occurring problems with hostility and anger rumination in ASD, the role of impoverished emotion regulation must also be considered. Clinically, it may be important to target anger rumination in young adults with higher traits of ASD in order to reduce hostility or aggression. In this study, ASD traits were positively associated with social anxiety, anger rumination, and facets of aggression. These findings contribute to a growing body of research, indicating that subthreshold symptoms of ASD are associated with psychosocial problems typically found in clinically diagnosed ASD, such as loneliness, isolation (Jobe and White, 2007), anxiety, depression (Rosbrook and Whittingham, 2010), anger, hostility, and aggression (White et al., 2012); difficulty with emotion regulation; and deficits in executive functioning (Christ et al., 2010). Results of this study also speak to the potential import of a transdiagnostic treatment approach targeting social difficulty and perseverative thinking in people who are highly socially anxious and who struggle with problems with

hostility and aggression. For such individuals, it may be beneficial to target cognitive reappraisal and redirect the focus of perseveration to more soothing topics or nonhostile foci.

Acknowledgments

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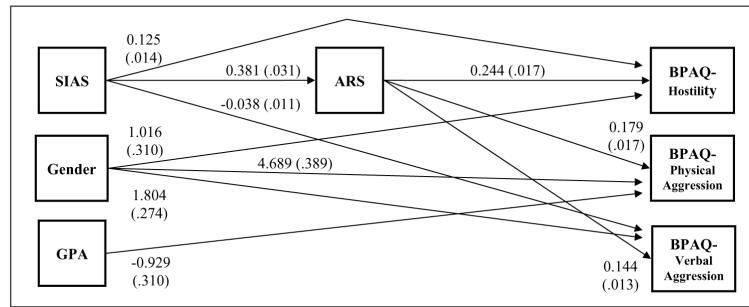
Figure 1.
Path diagram of the mediational relation between the SIAS, ARS, GPA, and the three BPAQ variables. To simplify the figure, nonsignificant paths have been removed; included paths are significant at the 0.05 level. Standard errors are presented in parentheses.

SIAS: Social Interaction Anxiety Scale; ARS: Anger Rumination Scale; GPA: grade point average; BPAQ: Buss Perry Aggression Questionnaire.
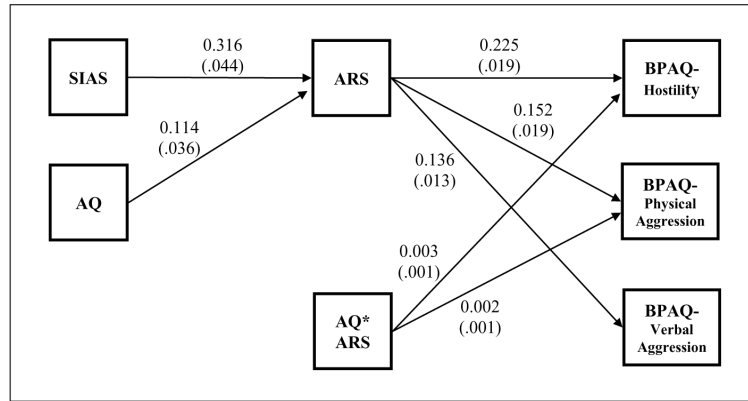
Figure 2.
Path diagram of the moderation effect of the AQ on the mediational relation between the SIAS, the ARS, and the three BPAQ variables, where AQ*ARS is the interaction term. To simplify the figure, nonsignificant paths; the direct paths between SIAS, AQ, and the three BPAQ variables; and the paths between gender, GPA, and the three BPAQ variables have been removed; included paths are significant at the 0.05 level. Standard errors are presented in parentheses.

AQ: Autism Spectrum Quotient; SIAS: Social Interaction Anxiety Scale; ARS: Anger Rumination Scale; BPAQ: Buss Perry Aggression Questionnaire; GPA: grade point average.

Table 1

Descriptive statistics for the total and scale scores.

Variable	Mean (standard deviation)	Minimum/Maximum
Age	19.70 (1.63)	(18.00, 46.00)
GPA	3.10 (0.57)	(0.00, 4.00)
SIAS	20.91 (11.74)	(3.00, 62.00)
ARS	34.61 (11.30)	(19.00, 76.00)
AQ	106.85 (13.40)	(63.00, 151.00)
BPAQ-Hostility	14.30 (5.56)	(8.00, 40.00)
BPAQ-Physical	16.15 (5.65)	(9.00, 38.00)
BPAQ-Verbal	10.41 (3.84)	(5.00, 25.00)

GPA: grade point average; SIAS: Social Interaction Anxiety Scale; ARS: Anger Rumination Scale; AQ: Autism Spectrum Quotient; BPAQ: Buss Perry Aggression Questionnaire.

Table 2

Correlations among study variables.

	Gender	GPA	SIAS	ARS	BPAQ Phys	BPAQ Verb	BPAQ Host	AQ4	AQ35	AQ36	AQ39	AQ42	AQ45
Gender	1.00												
GPA	0.07*	1.00											
SIAS	−0.05	0.03	1.00										
ARS	−0.05	−0.05	0.40**	1.00									
BPAQ Phys	−0.39**	−0.14**	0.12**	0.36**	1.00								
BPAQ Verb	−0.22**	−0.04	0.07*	0.39**	0.48**	1.00							
BPAQ Host	−0.12**	−0.05	0.47**	0.61**	0.38**	0.42**	1.00						
AQ4	−0.12**	−0.02	0.24**	0.36**	0.20**	0.23**	0.32**	1.00					
AQ35	0.17**	0.05	0.16**	0.12**	−0.04	−0.06	0.14**	0.09**	1.00				
AQ36	−0.09**	−0.08*	0.15**	0.03	0.05	−0.02	0.05	0.03	0.10**	1.00			
AQ39	−0.04	−0.04	0.19**	0.29**	0.12**	0.16**	0.30**	0.24**	0.27**	0.09**	1.00		
AQ42	−0.12**	−0.07*	0.12**	0.08*	0.10**	0.06	0.13**	0.08*	0.10**	0.10**	0.10**	1.00	
AQ45	−0.14**	−0.01	0.22**	0.13**	0.08*	0.03	0.21**	0.15**	0.28**	0.31**	0.23**	0.26**	1.00
AQ Total	−0.14**	−0.03	0.57**	0.34**	0.21**	0.13**	0.40**	0.28**	0.31**	0.37**	0.32**	0.27**	0.41**

GPA: grade point average; SIAS: Social Interaction Anxiety Scale Total; ARS: Anger Rumination Scale Total; BPAQ Phys: Buss Perry Aggression Questionnaire, Physical Aggression; BPAQ Verb: Buss Perry Aggression Questionnaire, Verbal Aggression; BPAQ Host: Buss Perry Aggression Questionnaire, Hostility; AQ Total: Autism Spectrum Quotient Total.

*
$p < 0.05$;

**
$p < 0.01$.