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The indirect effect of self-compassion in the association between autistic traits and anxiety/depression: A cross-sectional study in autistic and non-autistic adults.

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Abstract
This study followed a pre-registered analysis plan with the aim to investigate whether autistic traits and self-compassion are correlated in autistic adults, and to test an indirect effect of autistic traits on anxiety/depression via self-compassion. We present the findings of an online survey of 456 participants (n = 228 autistic adults, n = 228 non-autistic adults) who completed the Autism Spectrum Quotient (AQ), the Self-Compassion Scale (SCS), and the Hospital Anxiety and Depression Scale (HADS). Lower self-compassion was reported by autistic participants compared to non-autistic participants, and a negative correlation was found between autistic traits and self-compassion in both groups. Furthermore, an indirect association between autistic traits and anxiety/depression via self-compassion was observed in both samples. Considering that many autistic people experience co-occurring anxiety and depression, and that self-compassion is a skill that can be cultivated with practice, the findings of the current study suggest that self-compassion may be a modifiable factor that could improve the mental health of this population.

Lay Abstract
Previous research on non-autistic adults suggests self-compassion may serve to reduce mental health problems and promote psychological wellbeing. Correlations between autistic traits and self-compassion have been observed in general populations. In this study, we were interested in extending previous research by exploring relationships between autistic traits, self-compassion, and anxiety/depression in autistic adults without intellectual disability. The findings revealed that on average autistic people reported lower self-compassion than non-autistic people. Once we accounted for levels of self-compassion in our statistical model, this resulted in a complete loss of significance in the relationships between autistic traits and anxiety/depression. Self-compassion may be a useful target for clinical intervention in autistic adults with co-occurring mental health difficulties.

Keywords: Autism; Autistic Traits; Anxiety; Depression; Self-Compassion; Self Compassion
Introduction

Autism Spectrum Disorder (hereafter Autism) is a lifelong neurodevelopmental condition characterised by restricted and repetitive behaviours, altered sensory processing, and difficulties in social communication and interaction (American Psychiatric Association, 2013). Autism is diagnosed in approximately 1% of the UK population and at a higher rate in males than females (Baron-Cohen et al., 2009; Fombonne, 2009) at a ratio of approximately three males to every one female (Zablotsky et al., 2015). Co-occurring mental health conditions such as anxiety and depression are common (Griffiths et al., 2019). The most recent systematic review and meta-analysis reported that the pooled estimation of current and lifetime prevalence for autistic adults ranged from 27% and 42% for anxiety disorder, and 23% and 37% for depressive disorder (Hollocks et al., 2019).

Research on general population samples has examined phenomena relevant to autism by measuring autistic traits, a set of primary characteristics associated with the condition such as levels of social skill, communication abilities, and attention to detail (Baron-Cohen et al., 2001). The continuity between autism and autistic traits in the general population underscores that autism is a natural form of human diversity (Sasson & Bottema-Beutal, 2021). In favour of the conceptualisation that autism represents the high end of a continuum are the findings that autistic traits are continuously distributed throughout the general population (Ruzich et al., 2015) and that autistic people tend to score higher on measures of autistic traits than non-autistic people (Baron-Cohen et al., 2009; Baron-Cohen et al., 2014). However, it is important to note that researchers should not draw definitive conclusions about autism based solely on non-autistic samples (Sasson & Bottema-Beutal, 2021).

Self-compassion, as defined by Neff (2003), is an orientation to care for oneself during challenging times, and consists of interpreting and responding to life experiences and events in three distinct ways: 1) *self-kindness over self-judgement*: being kind and understanding towards oneself rather than being hostile and critical; 2) *common humanity over isolation*: perceiving one’s experiences as part of a shared human experience rather than holding the belief of being the only one experiencing suffering, and; 3) *mindfulness over over-identification*: holding painful thoughts and emotions in mindful
awareness so that feelings are not over-identified, suppressed, or exaggerated. The individual components of self-compassion are said to interact with each other to generate a self-compassionate frame of mind (Neff & Costigan, 2014) and research has supported the idea of a higher-order factor for self-compassion (Cleare et al., 2018; Neff et al., 2017).

There are several reasons to suspect autistic people may report on average lower self-compassion than non-autistic people. Many autistic people have difficulties with emotion regulation (Cai et al., 2018), may exaggerate or suppress their emotional reactions (Garon et al., 2008) and camouflage or hide their symptoms (Somerville et al., 2020). It is possible that these difficulties may result in, or be the result of, increased inward hostility. Studies also show that autistic people are more likely to experience trauma (Dodds, 2021), bullying (Humphrey & Hebron, 2015), and non-acceptance from others (Cage et al., 2018). This confluence of factors has the potential for high levels of self-criticism and self-blame. Furthermore, components of self-compassion such as a sense of common humanity might be challenging for autistic people considering key characteristics of autism include difficulties in social interaction and connecting with others (although note that this may not be the case for autistic-to-autistic person interactions; see Crompton et al., 2020 and Chen et al., 2021). In other words, it is possible that the interaction between cognitive styles akin to autism and the lived experiences of autistic people may increase the likelihood of low self-compassion in this population.

A meta-analysis focused on sex differences in self-compassion in the general population found a small ($d = 0.18$) but statistically significant difference, with females reporting on average lower self-compassion than males (Yarnell et al., 2015). Considering autistic females are more likely to internalise their problems (Bargiela et al., 2016; Mandy et al., 2012), and report higher rates of co-morbid mental health problems than autistic males (Rydzewska et al., 2018; Sedgewick et al., 2020), this sex difference may also extend to autistic samples. Previous research shows a positive association between self-compassion and age (Neff & Vonk, 2009), and differences in self-compassion have been observed across ethnic communities (Boyraz et al., 2020), suggesting demographic factors should also be included and controlled for in comparative studies.
Improvements in self-compassion have been reported in a variety of self-compassion interventions, such as compassion-focused therapy (CFT; Gilbert, 2009) and the mindful self-compassion program (Neff & Germer, 2013). A recent meta-analysis of randomised controlled trials found self-compassion interventions showed significant improvements across a range of psychological outcomes including self-criticism, stress, anxiety, and depression (Ferrari et al., 2019). Self-compassion has been linked to a range of mental health benefits in non-autistic adults, including higher wellbeing and life satisfaction (Zessin et al., 2015), and lower anxiety and depression (Macbeth & Gumley, 2012). From a theoretical standpoint, Gilbert (2009) explains how self-compassion activates affective regulation systems with feelings of contentment, safety, and connectedness, which help regulate elevated threat-oriented emotions in individuals with high levels of shame and self-criticism. Longitudinal studies show self-compassion provides emotional benefits over time (Neff & Vonk, 2009), including reductions in anxiety and depression (Stutts et al., 2018). A recent systematic review by Pullmer et al. (2019) examined 18 studies (11 cross-sectional, 7 longitudinal) on the relationship between self-compassion and depressive symptoms. The findings showed self-compassion is a malleable factor that leads to reductions in depressive symptoms (Pullmer et al., 2019). More specifically, the review concluded that self-compassion may protect against the development and maintenance of depressive symptoms by: (a) decreasing symptoms of depression both cross-sectionally and longitudinally; (b) explaining how risk factors impact depressive symptoms, and (c) interacting with risk factors to attenuate their detrimental effects.

These findings have led researchers to speculate on the role of self-compassion in the mental health experiences of autistic people (Cai & Brown, 2020; Howes et al., 2020). As suggested by Cai and Brown (2020) cultivating self-compassion in autistic people may help with efforts to reduce mental health problems in this population. For instance, it is well-established that cognitive-developmental factors influence emotion and social development (Serafica, 1982), and these processes could foster compassionate versus self-critical inner dialogues (Neff, 2009). Considering autistic people are at higher risk of mental health problems than non-autistic people (Lai et al., 2019), and that autistic people process and respond to emotional events differently to non-autistic people (Winkielman et al., 2009),
research is needed to explore the correlates of self-compassion in an autistic sample. Previous research focused on general population samples revealed negative correlations between autistic traits and self-compassion \((r = -0.51\) in Howes et al., 2020; \(r = -0.46\) in Galvin et al., 2021). In the study by Galvin et al. (2021), an indirect effect was found between autistic traits and anxiety/depression via self-compassion in an undergraduate student sample. In the current study, we aim to replicate and extend this research in an autistic sample.

We pre-registered our hypotheses and analysis plan on the Open Science Framework (osf.io/gdk4x), with the aim to investigate whether autistic traits and self-compassion are correlated in autistic adults, and whether an indirect effect via self-compassion exists in the pathways between autism diagnostic status/autistic traits and anxiety/depression. Our main predictions were that self-compassion would be lower in autistic adults than non-autistic adults and that a negative correlation would be found between autistic traits and self-compassion in both autistic and non-autistic adults. Furthermore, we predicted an indirect effect would be observed in both autistic and non-autistic samples for the associations between autism diagnostic status/autistic traits and anxiety/depression via self-compassion.

**Method**

Ethical approval was provided by the Faculty Research Ethics Committee at <<blinded>> (approval number: <<blinded>>).

**Design**

The study employed a cross-sectional online survey design (hosted on Qualtrics). The predictor variables were autism diagnostic status (autism diagnosis or no autism diagnosis) and autistic traits; the hypothesised mediator was self-compassion, and the outcomes were anxiety and depression.

**Sampling and Procedure**

To determine the required sample size for the mediation models we used the Monte Carlo Power Analysis Simulation application developed by Schoemann et al. (2017). Based on the associations
reported by Galvin et al. (2021), 5000 replications, 80% power, and alpha set at $p < 0.05$ (two-tailed), a minimum of 104 participants were required to observe a statistically significant indirect effect. However, as we also planned to conduct further comparisons and correlation analyses, we aimed to collect data from as many participants as possible within the funding budget for this study. Participants were therefore 228 autistic (114 males, 114 females) and 228 non-autistic adults (114 males, 114 females) (total N = 456), without intellectual disability, recruited on the participant recruitment website Prolific: www.prolific.co. Prolific was chosen because recent studies showed the platform produced better quality data than other participant recruitment panels (Peer et al., 2021; Stanton et al., 2022) and the participant pool can be targeted through a pre-screening selection feature. Each participant received £1.50 for taking part. Sample characteristics are presented in Table 1.

**Table 1.** Participant characteristics in the autistic and non-autistic samples. $M$ mean, $SD$ standard deviation.

<table>
<thead>
<tr>
<th></th>
<th>Autistic adults</th>
<th>Non-autistic adults</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex n(%)</td>
<td>Male 114(50); Female 114(50)</td>
<td>Male 114(50); Female 114(50)</td>
</tr>
<tr>
<td>Age in years $M$, $SD$ (range)</td>
<td>30.50, 9.473 (18-60)</td>
<td>33.13, 11.078 (19-69)</td>
</tr>
<tr>
<td>Ethnicity n(%)</td>
<td>White 199(87.3)</td>
<td>White 195(85.5)</td>
</tr>
<tr>
<td></td>
<td>Asian / Asian British 9(3.9)</td>
<td>Asian / Asian British 20(8.8)</td>
</tr>
<tr>
<td></td>
<td>Black / Black British 7(3.1)</td>
<td>Black / Black British 6(2.6)</td>
</tr>
<tr>
<td></td>
<td>Hispanic or Latino 1(0.4)</td>
<td>Black other 1(0.4)</td>
</tr>
<tr>
<td></td>
<td>Mixed ethnicity 9(3.9)</td>
<td>Middle / Near Eastern 1(0.4)</td>
</tr>
<tr>
<td></td>
<td>Middle / Near Eastern 3(1.3)</td>
<td>Hispanic or Latino 1(0.4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mixed ethnicity 4(1.8)</td>
</tr>
<tr>
<td>Autism diagnosis n(%)</td>
<td>Yes 228(100)</td>
<td>Yes 0(0)</td>
</tr>
<tr>
<td></td>
<td>No, but I suspect that I have this condition 0(0)</td>
<td>No, but I suspect that I have this condition 0(0)</td>
</tr>
<tr>
<td></td>
<td>No 0(0)</td>
<td>No 228(100)</td>
</tr>
<tr>
<td>Generalised anxiety diagnosis n(%)</td>
<td>Yes 157(68.9)</td>
<td>Yes 62(27.2)</td>
</tr>
<tr>
<td></td>
<td>No, but I suspect that I have this condition 44(19.3)</td>
<td>No, but I suspect that I have this condition 64(28.1)</td>
</tr>
<tr>
<td></td>
<td>No 27(11.8)</td>
<td>No 102(44.7)</td>
</tr>
<tr>
<td>Depression diagnosis</td>
<td>Yes 140(61.4)</td>
<td>Yes 61(26.8)</td>
</tr>
<tr>
<td></td>
<td>No, but I suspect that I have this condition 39(17.1)</td>
<td>No, but I suspect that I have this condition 43(18.9)</td>
</tr>
<tr>
<td></td>
<td>No 49(21.5)</td>
<td>No 124(54.4)</td>
</tr>
<tr>
<td>Eating disorder</td>
<td>Yes 32(14.0)</td>
<td>Yes 6(2.6)</td>
</tr>
<tr>
<td>Condition</td>
<td>Yes</td>
<td>No, but I suspect that I have this condition</td>
</tr>
<tr>
<td>------------------------------------------------</td>
<td>-------------</td>
<td>---------------------------------------------</td>
</tr>
<tr>
<td>Obsessive Compulsive Disorder (OCD) diagnosis</td>
<td>Yes 27(11.8)</td>
<td>No, but I suspect that I have this condition 59(25.9)</td>
</tr>
<tr>
<td>Attention Deficit Hyperactivity Disorder (ADHD)</td>
<td>Yes 42(18.4)</td>
<td>No, but I suspect that I have this condition 62(27.2)</td>
</tr>
</tbody>
</table>

Pre-screening for autistic and non-autistic samples on the Prolific platform

We took several steps to increase confidence in the data obtained from Prolific. The first step involved the use of the Prolific pre-screen feature, which enabled the recruitment of a sample that was distributed equally across selected demographics. We selected autism diagnostic status, as well as geographic location (UK only) and sex (equal male/female split within groups). In relation to autism diagnostic status, participants recruited in the autistic sample must have responded to the following pre-screen question (when setting up their Prolific account): “Have you received a formal clinical diagnosis of autism spectrum disorder, made by a psychiatrist, psychologist, or other qualified medical specialist? This includes Asperger’s syndrome, Autism Disorder, High Functioning Autism or Pervasive Developmental Disorder” with “Yes – as a child” or “Yes – as an adult”. Participants in the non-autistic sample must have responded to this question with “No”.

As an additional step, participants were required to confirm their eligibility for inclusion in the study based on their diagnostic status on the consent form. However, as it was possible that participants may have responded incorrectly to the pre-screening questionnaire, received an autism diagnosis since registering with Prolific, and/or failed to appropriately read the consent form, we added a question at the beginning of the survey to further confirm diagnostic status. Participants were asked “Have you ever been diagnosed with any of the following conditions?”. Three response options were possible for each condition in the list: ‘Yes’, ‘No, but I suspect that I have this condition’ and ‘No, and I do not suspect I have this condition’. The table above summarizes the responses for Obsessive Compulsive Disorder (OCD) and Attention Deficit Hyperactivity Disorder (ADHD).
have this condition’. If a participant in the autistic sample responded to the autism item with ‘No, but I suspect I have this condition’ or ‘No, and I do not suspect that I have this condition’ they were redirected to the end of the survey as they did not meet the inclusion criteria. This was also the case for participants in the non-autistic sample who responded with ‘Yes’ or ‘No, but I suspect that I have this condition’.

As it is known that there can be some low-quality responses when recruiting participants on crowdsourcing platforms (Jones et al., 2022), we also included two attention control items embedded within the questionnaires to ensure the participants were reading and engaging with the questions appropriately: “This item is to check you are paying attention, please answer with definitely disagree”. Participants failing one attention control were given the benefit of the doubt and retained in the dataset. Failing both attention controls resulted in the removal of the participant’s data. When this occurred, additional participants were recruited as a replacement to ensure we reached the final target sample size. In total, \( n = 32 \) (\( n = 13 \) in the autistic, \( n = 19 \) in the non-autistic sample) failed one attention control item and an additional \( n = 14 \) (\( n = 3 \) in the autistic sample, \( n = 11 \) in the non-autistic sample) failed both.

**Materials**

Participants reported their sex (male, female, prefer not to say, prefer to self-describe), age, ethnicity, and whether they were diagnosed with or suspected autism, anxiety, depression, eating disorder, obsessive compulsive disorder (OCD) or attention deficit hyperactivity disorder (ADHD). Autistic traits were measured using the Autism Spectrum Quotient (AQ; Baron-Cohen et al., 2001), a 50-item self-report questionnaire. Each item has four response options (‘definitely agree’, ‘slightly agree’, slightly disagree’ and ‘definitely disagree’) and response options are coded with either 0 or 1 (the direction of coding differs across items). The AQ comprises five trait subscales (social skill, attention switching, attention to detail, communication, and imagination), with the subscales being summed to provide an overall score. The AQ has been shown to be a reliable and valid measure of autistic traits, which can
differentiate between autistic and non-autistic adults (Woodbury-Smith et al., 2005). Internal consistency (Cronbach’s alpha) in the current study for AQ total score was $\alpha = 0.921$.

Self-compassion was measured with the Self-Compassion Scale (SCS; Neff, 2003), a 26-item measure on a 5-point scale (1 = almost never to 5 = almost always). The SCS produces a total self-compassion score and six subscales: three positive (self-kindness, common humanity, and mindfulness) and three negative (self-judgement, isolation, and over-identification). Total self-compassion was calculated by reverse-scoring the negative subscale items and computing a total mean. Example items include “I’m disapproving and judgemental about my own flaws and inadequacies” and “When things are going badly for me, I see the difficulties as part of life that everyone goes through”. Although the psychometric properties of the SCS have not yet been examined in autistic people, the SCS has been found to be a reliable and valid measure in general population samples as well as various clinical groups and has been shown to be psychometrically equivalent across groups. This includes samples from a range of clinical disorders including borderline personality disorder, eating disorder, anxiety and depression (e.g., see Costa et al., 2016; Toth-Kiraly & Neff, 2021). For self-compassion total score, internal consistency in the current study was $\alpha = 0.942$ and for the subscales: self-kindness $\alpha = 0.846$, common humanity $\alpha = 0.827$, mindfulness $\alpha = 0.791$, self-judgement $\alpha = 0.815$, isolation $\alpha = 0.786$, and over-identification $\alpha = 0.806$.

To measure anxiety and depression we used the Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983). The HADS is a 14-item measure designed to assess an individual’s mental state over the previous two weeks. Items are scored on a 0-3 scale (response options vary across items), with seven items summed to provide a score for anxiety and seven items summed to provide a score for depression. The HADS is frequently used for research purposes as well as a clinical screening tool for anxiety and depression and has been shown to be reliable and valid for use in both autistic and non-autistic people (Bocéréan & Dupret, 2014; Uljarević et al., 2018). Internal consistency for HADS anxiety was $\alpha = 0.867$, and for HADS depression $\alpha = 0.806$. 
Data Analysis

The analysis plan was pre-registered on the Open Science Framework (osf.io/gdk4x) and we only deviate from this plan where specified. The statistical package SPSS (version 28) was used to analyse the data, and effects are considered statistically significant when \( p < 0.05 \). A series of 2 (autistic or not autistic) \( \times \) 2 (male or female) factorial ANOVAs were used to examine differences between groups on AQ total score, SCS total score, and HADS anxiety and depression subscales. Partial eta squared (\( \eta^2_p \)) was used to determine effect size for group differences, with \( \eta^2_p = 0.01 \) interpreted as a small effect size, \( \eta^2_p = 0.06 \) a medium effect size, and \( \eta^2_p = 0.14 \) a large effect size. Pearson’s correlation analyses were used to examine associations between the main study variables. Group differences in the strength of correlations between AQ and SCS were examined with Fisher’s \( r \)-to-\( z \) tests. Mediation models were then calculated using Hayes’ tool (PROCESS model 4 option) with 5000 bootstrap resamples (Hayes, 2017). Statistical significance was inferred from 95% bias corrected and accelerated confidence intervals (BCa 95CI). If the BCa 95CI included zero, then the effect was inferred to be non-significant.

The predictor variable in the first mediation model was autism diagnostic status, the mediator SCS total score, and the outcome HADS anxiety. The predictor in the second model was autism diagnostic status, the mediator SCS total score, and the outcome HADS depression. Next, we conducted four separate mediation models (two per subsample) to test a possible indirect effect between AQ total score and HADS anxiety/depression via SCS total score. There were six mediation models in total and all models included sex, age, and ethnicity as covariates. We dichotomised the ethnicity variable to compare white participants with non-white participants (white = 1, non-white = 0). This was necessary due to sample sizes in ethnic groups being too small to make meaningful comparisons.

Community Involvement Statement

We did not use a participatory or co-design approach. We adopted the guidelines for good research practice with autistic people provided on the Autistica website (https://www.autistica.org.uk/our-research/research-toolkit/good-practice) developed by Maria Ashworth, Jade Davies and Laura Crane. In the debrief form we invited autistic and non-autistic participants to contact us with feedback
anonymously via the Prolific messaging service. Several autistic people got in touch and were positive about the aims of the research and discussed their personal stories with self-compassion and mental health.

Data Availability Statement
The data file and analysis scripts for this study are openly available on the OSF website: osf.io/54m7d

Results
Sex and autism diagnostic status as predictors of autistic traits, self-compassion, anxiety, and depression

Descriptive statistics for the main study variables are detailed in Table 2. The 2 (autistic or not autistic) × 2 (male or female) factorial ANOVA results are illustrated in Figure 1. For autistic traits, the main effect for diagnosis was statistically significant, $F(1, 452) = 335.998, p < 0.001, \eta^2_p = 0.426$ (large effect size), with higher autistic traits in the autistic sample. However, no significant main effect was observed for sex $F(1, 452) = 1.004, p = 0.317, \eta^2_p = 0.002$. For self-compassion, the main effects for diagnosis, $F(1, 452) = 57.474, p < 0.001, \eta^2_p = 0.113$ (medium to large), and sex, $F(1, 452) = 13.073, p < 0.001, \eta^2_p = 0.028$ (small), were both statistically significant, with lower self-compassion in the autistic sample compared to the non-autistic sample and in females compared to males. For HADS anxiety, a significant main effect was found for diagnosis, $F(1, 452) = 44.408, p < 0.001, \eta^2_p = 0.089$ (medium), and sex, $F(1, 452) = 35.958, p < 0.001, \eta^2_p = 0.074$ (medium), with higher anxiety in the autistic sample compared to the non-autistic sample and in females compared to males. Finally, for HADS depression, a significant main effect was found for diagnosis, $F(1, 452) = 32.007, p < 0.001, \eta^2_p = 0.066$ (medium), with higher depression in the autistic sample compared to the non-autistic sample, but no significant main effect was found for sex, $F(1, 452) = 0.802, p = 0.371, \eta^2_p = 0.002$. In this study an interaction between sex and diagnostic group was not hypothesised, only main effects of sex and
diagnostic group. However, the diagnosis*sex interaction term was included in the ANOVA by default and, for completeness, we report that the interaction term was not significant in any of the models.

Additional (not pre-registered) comparisons

Considering that a significant main effect of sex was observed for self-compassion, and autistic females reported lower self-compassion than all other groups, we wanted to probe this relationship further and therefore conducted additional (not pre-registered) pairwise comparisons using independent samples t-tests. The results showed that autistic females reported significantly lower self-compassion than autistic males $t(226) = -3.095, p = 0.001, \eta_p^2 = 0.021$ (small effect), non-autistic females $t(226) = -5.572, p < 0.001, \eta_p^2 = 0.063$ (medium effect), and non-autistic males $t(226) = -8.356, p < 0.001, \eta_p^2 = 0.133$ (medium to large effect).

**Figure 1.** Violin boxplots of AQ total score, SCS total score, anxiety and depression. The top row presents the data stratified by diagnostic status and the second and third row presents the data stratified by diagnostic status and sex.
Table 2. Participant characteristics stratified by diagnostic status and sex.

<table>
<thead>
<tr>
<th></th>
<th>Autistic (All)</th>
<th>Autistic females</th>
<th>Autistic males</th>
<th>Non-autistic (All)</th>
<th>Non-autistic females</th>
<th>Non-autistic males</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>M</td>
<td>SD</td>
<td>N</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>AQ total score</td>
<td>228</td>
<td>33.95</td>
<td>8.38</td>
<td>114</td>
<td>34.89</td>
<td>8.43</td>
</tr>
<tr>
<td>SCS total score</td>
<td>228</td>
<td>2.17</td>
<td>0.64</td>
<td>114</td>
<td>2.04</td>
<td>0.62</td>
</tr>
<tr>
<td>SCS self-kindness</td>
<td>228</td>
<td>2.23</td>
<td>0.82</td>
<td>114</td>
<td>2.15</td>
<td>0.82</td>
</tr>
<tr>
<td>SCS common humanity</td>
<td>228</td>
<td>2.39</td>
<td>0.89</td>
<td>114</td>
<td>2.28</td>
<td>0.87</td>
</tr>
<tr>
<td>SCS mindfulness</td>
<td>228</td>
<td>2.60</td>
<td>0.86</td>
<td>114</td>
<td>2.47</td>
<td>0.82</td>
</tr>
<tr>
<td>SCS self-judgement</td>
<td>228</td>
<td>4.08</td>
<td>0.76</td>
<td>114</td>
<td>4.25</td>
<td>0.69</td>
</tr>
<tr>
<td>SCS isolation</td>
<td>228</td>
<td>4.02</td>
<td>0.78</td>
<td>114</td>
<td>4.13</td>
<td>0.82</td>
</tr>
<tr>
<td>SCS over-identification</td>
<td>228</td>
<td>4.05</td>
<td>0.80</td>
<td>114</td>
<td>4.23</td>
<td>0.74</td>
</tr>
<tr>
<td>HADS anxiety</td>
<td>228</td>
<td>12.30</td>
<td>4.72</td>
<td>114</td>
<td>13.54</td>
<td>4.44</td>
</tr>
<tr>
<td>HADS depression</td>
<td>228</td>
<td>8.72</td>
<td>4.24</td>
<td>114</td>
<td>8.74</td>
<td>4.03</td>
</tr>
</tbody>
</table>

Note. M: mean; SD: standard deviation; AQ: Autism Spectrum Quotient; SCS: Self Compassion Scale; HADS: Hospital Anxiety and Depression Scale. The negative SCS subscales (self-judgement, isolation, over-identification) are not reversed scored in this table for ease of interpretation.
Correlation analyses

In the autistic group, significant positive correlations were found between AQ total score and HADS anxiety \((r = 0.279, p < 0.001)\) and AQ total score and HADS depression scores \((r = 0.229, p < 0.001)\). Significant negative correlations were found between AQ total score and SCS total score \((r = -0.472, p < 0.001)\), SCS total score and HADS anxiety \((r = -0.459, p < 0.001)\), and SCS total score and HADS depression \((r = -0.391, p < 0.001)\). In the non-autistic group, significant positive correlations were found between AQ total score and HADS anxiety \((r = 0.276, p < 0.001)\) and AQ total score and HADS depression \((r = 0.401, p < 0.001)\). Significant negative correlations were found between AQ total score and SCS total score \((r = -0.336, p < 0.001)\), SCS total score and HADS anxiety \((r = -0.603, p < 0.001)\), and SCS total score and HADS depression \((r = -0.651, p < 0.001)\). Although not pre-registered, we also applied the Bonferroni adjustment for the correlation analyses to align with the findings of previous research (Galvin et al., 2022). All correlations remained statistically significant after Bonferroni adjustment \((\text{adjusted alpha value} = 0.005)\).

Group differences in associations between autistic traits and self-compassion

Fisher’s \(r\)-to-\(z\) test was used to compare diagnostic groups (autistic versus non-autistic) in the strength of correlation between AQ total score and SCS total score. It was found that the correlation was stronger in autistic \((r = -0.472)\) than non-autistic individuals \((r = -0.336)\), \(z = -1.73\), and although this represented a very small difference it was statistically significant \(p = 0.042\) (see Figure 2). We next compared autistic and non-autistic groups in the strength of correlations between AQ total score and the six SCS subscales. The results are available in Table 3. It was found that the correlations between autistic traits and self-kindness \((z = -2.077, p = 0.019)\) and autistic traits and self-judgement \((z = 1.981, p = 0.024)\) were significantly stronger in the autistic compared to the non-autistic sample, although these differences did not remain statistically significant after Bonferroni correction \((\text{adjusted alpha value} = 0.008)\). No significant differences in the slopes were found for common humanity, isolation, mindfulness, or over-identification.
**Figure 2.** Scatterplot for the association between AQ total score and SCS total score stratified by autism diagnostic status. _AQ_ Autism Spectrum Quotient, _SCS_ Self-Compassion Scale.

**Table 3.** Fisher’s _r_ -to- _z_ tests comparing the correlations between autistic traits and self-compassion subscales between autistic and non-autistic groups.

<table>
<thead>
<tr>
<th></th>
<th>Self-kindness</th>
<th>Self-judgement</th>
<th>Common humanity</th>
<th>Isolation</th>
<th>Mindfulness</th>
<th>Over-Identification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autistic sample (Pearson’s <em>r</em> )</td>
<td>-0.436***</td>
<td>0.342***</td>
<td>-0.396***</td>
<td>0.313***</td>
<td>-0.398***</td>
<td>0.328***</td>
</tr>
<tr>
<td>Non-autistic sample (Pearson’s <em>r</em> )</td>
<td>-0.265***</td>
<td>0.168*</td>
<td>-0.317***</td>
<td>0.328***</td>
<td>-0.308***</td>
<td>0.265***</td>
</tr>
<tr>
<td>Fisher’s <em>r</em> -to- <em>z</em> ( <em>z</em> )</td>
<td>-2.077*</td>
<td>1.981*</td>
<td>-0.961</td>
<td>-0.177</td>
<td>-1.092</td>
<td>0.232</td>
</tr>
</tbody>
</table>

*Note.* *** _p_ < 0.001, * _p_ < 0.05

**Association between autism and anxiety/depression via self-compassion**

The first mediation model ( _N_ = 456) was used to investigate self-compassion as a potential mediator between autism diagnostic status (non-autistic = 0, autistic = 1) and anxiety. Figure 3a shows that the indirect effect of autism diagnosis on anxiety via self-compassion was significant ( _ab_ = 1.608, BCa 95% CI [1.157, 2.096]), with the mediator accounting for 58.8% of the total effect of autism diagnosis on anxiety. The second mediation model ( _N_ = 456) investigated self-compassion as a potential mediator between autism diagnostic status and depression (Figure 3b). The indirect effect of autism diagnosis on
depression via self-compassion was significant ($ab = 1.516$, BCa 95% CI [1.086, 1.982]), with the mediator accounting for 68.3% of the total effect of autism diagnosis on depression.

*The indirect effect of self-compassion in the association between autistic traits and anxiety/depression*

Next, separate mediation analyses (stratified by diagnostic status) were conducted to examine the associations between autistic traits and anxiety/depression via self-compassion. In the autistic sample ($N = 228$), the indirect effects were significant in both models (anxiety: $ab = 0.105$, BCa 95% CI [0.062, 0.151]; depression: $ab = 0.092$, BCa 95% CI [0.055, 0.135]). For the anxiety model (Figure 4a), the mediator accounted for 68.3% of the total effect, and for the depression model (Figure 4b), it accounted for 81.8% of the total effect. In the non-autistic sample ($N = 228$), the indirect effects were also significant in both models (anxiety: $ab = 0.104$, BCa 95% CI [0.060, 0.151]; depression: $ab = 0.101$, BCa 95% CI [0.057, 0.150]). For the anxiety model (Figure 5a), the mediator accounted for 63.6% of the total effect, and for the depression model (Figure 5b), it accounted for 48.3% of the total effect.

**Figure 3.** Mediation model of the association between autism diagnostic status and (a) anxiety and (b) depression via self-compassion.
Figure 4. Mediation model of the association between autistic traits and (a) anxiety and (b) depression via self-compassion in the autistic sample.

\[ a_{path} = -0.035 \] \([-0.044, -0.026]\]

\[ ab_{path} = 0.105 \] \([0.062, 0.151]\]

\[ b_{path} = -2.089 \] \([-3.948, -0.030]\]

\[ c_{path} = 0.151 \] \([0.081, 0.226]\)

\[ c'_{path} = 0.040 \] \([-0.026, 0.124]\]

Figure 5. Mediation model of the association between autistic traits and (a) anxiety and (b) depression via self-compassion in the non-autistic sample.

\[ a_{path} = -0.035 \] \([-0.044, -0.025]\]

\[ ab_{path} = 0.092 \] \([0.055, 0.135]\]

\[ b_{path} = -2.629 \] \([-3.342, -1.717]\]

\[ c_{path} = 0.113 \] \([0.045, 0.181]\)

\[ c'_{path} = 0.021 \] \([-0.051, 0.092]\)
Discussion

The current study replicated previous studies focused on the relationships between autistic traits, self-compassion, and anxiety/depressive symptoms in non-autistic samples (Howes et al., 2020; Galvin et al., 2021) and extended this research to an autistic sample. Investigation of these relationships in autistic people is important because self-compassion may serve to reduce anxious/depressive symptomatology and could be a target for clinical intervention in this group. As predicted in our pre-registration, lower self-compassion was reported by autistic adults compared to non-autistic adults, and a negative correlation was found between autistic traits and self-compassion in both groups. An autism diagnosis was predictive of higher anxiety and depression, and lower self-compassion, and an indirect effect was observed for the association between autism diagnosis and anxiety/depression via self-compassion. It is notable that including self-compassion as a mediator resulted in complete loss of statistical significance in the relationship between autistic traits and anxiety/depression in the autistic sample. An indirect effect was also observed in the non-autistic sample, which replicated previous research findings (Galvin et al., 2021).

The observation that autistic individuals reported lower self-compassion than non-autistic individuals is noteworthy. Previous research shows that individuals low in self-compassion often experience high levels of self-criticism and self-blame, as well as a deep-seated sense of shame (Gilbert & Irons, 2009; Ehret et al., 2015). Considering shame and self-blame are also linked with high levels of avoidance and guilt (Gilbert & Woodyatt, 2017), low self-compassion may contribute significantly to mental health difficulties in autistic people. Similar relationships have recently been observed in the context of ADHD (Beaton et al., 2022), with lower levels of self-compassion contributing to poorer mental health in adults with ADHD compared to adults without ADHD. Thus, further research is required to determine possible shared mechanisms across neurodevelopmental conditions and at different stages of development. For instance, an understanding of how self-compassion initially develops and how it relates to symptom onset from a young age remains unknown.
Although a statistically significant sex difference for self-compassion was observed, it should be noted that this was only a small effect size in the overall group analysis. Further exploratory analyses (not pre-registered) revealed that autistic females reported significantly lower self-compassion than all the other groups in this study i.e., autistic males (with a small effect size), non-autistic females (medium effect size), and non-autistic males (medium to large effect size). This is concerning because autistic females are also more likely to camouflage or hide their autistic traits (Hull et al., 2020), internalise their problems (Bargiela et al., 2016; Mandy et al., 2012) and may be less likely to seek social support (Humphrey & Symes, 2010; Alvarez-Fernandez et al., 2017). This pattern of behaviour could result in low self-compassionate responses (e.g., shaming or attacking the self) going unnoticed in autistic women. In contrast, cultivating self-compassion skills may increase help-seeking behaviours in autistic people because high self-compassion is related to a greater understanding, expression and verbalisation of challenges faced (Neff, 2003), and can reduce perceived and anticipated stigma of seeking help (Heath et al., 2018).

The indirect effects observed in the autistic sample suggest that autistic traits may exert some of their influence on anxiety and depression via levels of self-compassion. One clinically relevant interpretation of these results is that the severity of autistic features in autistic and non-autistic people could make mental health problems more severe when low self-compassion is present. Future research should examine self-compassion along with other well-established factors in the relationship between autistic traits and anxiety/depression (e.g., alexithymia, emotion regulation, camouflaging) to further understand the role of self-compassion in the mental health experiences of autistic people. It is also essential that future research determines whether current measures of self-compassion (such as the self-compassion scale) are appropriate tools to study self-compassion in autistic adults. This research need is highlighted by the finding that autistic people may interpret measures/wording of questions differently than non-autistic people (Cassidy et al., 2018; Pelton et al., 2020).

Of particular importance is that clinicians need more information on the most appropriate and efficacious strategies to help autistic people cultivate self-compassion. To serve as a speculative
example, common skills training in compassion-based therapies include attention/sensory focusing, perspective-taking, and the use of imagery (Gilbert, 2014), all of which may be inappropriate or more difficult for autistic people. Compassionate thought work or working with a direct focus on cultivating compassionate feelings (warmth, kindness, courage, affiliation to self and other autistic people, and safeness) may be more useful for this population. Thus, the main goal for future research should be to examine the efficacy of self-compassion interventions and their components in autistic adults with carefully designed randomised control trials.

The current study has several strengths and limitations. Strengths include a balanced sample based on autism diagnostic status, sex, and geographic location (UK), as well as an a priori power calculation which allowed sufficient power to detect effects in stratified groups. We also implemented Open Science practices by pre-registering our hypotheses and analysis plan and took several steps in the recruitment strategy to increase confidence in the data obtained from the crowdsourcing website. Limitations of the study include the cross-sectional design, which does not permit strong inferences regarding directionality and may introduce biased estimates (Maxwell & Cole, 2007). Although previous longitudinal research on non-autistic samples has determined that predictive models should include self-compassion as preceding mental health outcomes as opposed to mental health preceding self-compassion (e.g., Stutts et al., 2018; Pullmer et al., 2019), further research is necessary to establish directionality in autistic samples. We want to be clear that due to the cross-sectional design of this study a strict mediation model is not being tested. Rather, the indirect tests are testing whether the studied variables share a significant amount of variance. Demonstrating these indirect effects is an important first step that can provide evidence for testing mediation models in future longitudinal studies.

A further limitation is that the data was self-report and drawn from a crowdsourcing website. Although participant responses to the attention control items suggested good quality data overall, these items were created by the authors and therefore may lack validity. Finally, our data does not include individuals without a medical diagnosis of autism but who identify as autistic, or those with an intellectual
disability. Future research should explore the self-compassion experiences of a wider range of autistic people.

In conclusion, the findings of this study show that autistic adults reported lower self-compassion than non-autistic adults, that the negative correlation between autistic traits and self-compassion was stronger in autistic than non-autistic adults, and that the indirect effects between autistic traits and anxiety/depressive symptomatology via self-compassion were observed in both groups. Considering that many autistic people experience co-occurring anxiety and depression, and that self-compassion is a skill that can be cultivated with practice, the findings of the current study suggest that self-compassion may be a modifiable factor that could improve the mental health of this population.

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