




# Gelotophobia in adults with and without autism spectrum disorder

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## Abstract

**Background.** Gelotophobia is a fear of being laughed at which can be slight, marked, or extreme. This study aimed to investigate gelotophobia, peer-attachment, emotional regulation, social functioning, and extraversion in 230 adults with autism spectrum disorder (ASD) and in 272 neurotypical individuals. **Methods.** Questionnaires included the GELOPH<15>, Autism Spectrum Quotient 10-items, Inventory of Parent and Peer attachment, Emotional Regulation Questionnaire, Social Functioning Questionnaire, and the NEO-FFI-3. **Results.** The groups significantly differed in gelotophobia symptomatology with 72.2% of the ASD and 25% of the neurotypical group over the threshold for gelotophobia. All variables, except for social functioning, were significant predictors of gelotophobia in both groups. **Conclusions.** This novel study expanded on the existing literature by emphasising factors which may influence gelotophobia development in adults with ASD.

**Keywords** Autism spectrum disorder · Gelotophobia · Laughter · Teasing · Comorbidity · Fear of being laughed at

## Introduction

Autism spectrum disorder (ASD) is one of the most prevalent neurodevelopmental disorders, with recent figures from the Centers for Disease Control and Prevention estimating that one in 36 individuals have ASD (Maenner et al., 2023). ASD is characterised in the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, Text Revision (DSM-5-TR) by social or communication impairments, in addition to restricted or repetitive behaviours (American Psychiatric Association, 2022). Comorbidity is when one or more physical or psychiatric conditions present themselves in addition to a primary condition. High levels of comorbidity have been observed in ASD samples including conditions such as epilepsy, attention-deficit/hyperactivity disorder (ADHD), gastrointestinal symptoms, challenging behaviour, feeding and toileting issues, sleep conditions, depression and anxiety (Foody et al., 2014; Leader & Mannion, 2016a, b;

Matson & Cervantes, 2014; Murray et al., 2022a, b). Lugo-Marín et al. (2019) conducted a meta-analysis which found that 55% of adults with ASD had a co-occurring psychiatric diagnosis. It is important to study comorbidity in ASD as these individuals are particularly susceptible to developing co-occurring conditions.

Although not considered a medical condition, one issue which can be present in those with ASD is gelotophobia. Gelotophobia is often described as an intense fear of being made fun of, laughed at or ridiculed. Gelotophobia can be slight, marked or extreme depending on the intensity of the symptoms. Although most people dislike being laughed at, they tend to recover quickly from being ridiculed. By contrast, people who experience gelotophobia report intense feelings of anxiety at the prospect of being laughed at (Platt et al., 2010), and research suggest that gelotophobia is strongly associated with social anxiety (Edwards et al., 2010). Relatedly, people with gelotophobia may misinterpret benign social interactions as instances of being ridiculed by others (Ruch et al., 2017). Gelotophobia is not simply an aversion to being made fun of—rather, it often constitutes a deep-seated belief that one is being mocked or belittled by others, resulting in feelings of intense shame and humiliation (Boda-Ujlaky & Séra, 2016). Such a presentation has led to the hypothesis that gelotophobia can be conceptualised as a subtype of social anxiety disorder (SAD; Havranek et al., 2017). This hypothesis was tested

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by Havranek et al. (2017), who found significantly higher levels of gelotophobic symptoms among individuals with SAD compared to a control group. The authors therefore recommended that gelotophobia ought to be considered as a diagnostic criterion when screening for SAD. However, in the absence of extensive literature on gelotophobia, it is difficult to make informed decisions concerning treatment and evaluation. As such, it is important to consider how gelotophobia may interact with a broader range of psychiatric and neurodevelopmental factors.

Gelotophobia positively relates to avoidant anxious attachment (Brauer et al., 2020; Brauer & Proyer, 2020) and its development is linked to recollection of being ridiculed in childhood by a father (Canestrari et al., 2021). Higher expressions of gelotophobia can reduce the likelihood of entering romantic relationship and experiencing satisfaction in relationships (Brauer et al., 2020; Brauer & Proyer, 2020). Gelotophobia is positively associated with romantic jealousy (Brauer et al., 2021), cyberbullying (Canestrari et al., 2021), and the use of withdrawal strategies when facing problems (Canestrari et al., 2023). Gelotophobia is also related to misinterpreting the facial expressions of others and judgements about social interactions (Brauer & Proyer, 2021).

Individuals with ASD are known to have marked deficits in social and communicative abilities (Watkins et al., 2017). Although individuals with ASD can understand, enjoy, and engage with many forms of humour (Pexman et al., 2011; Wu et al., 2016) such as puns, sarcasm, irony, and riddles, they can struggle with some types of humour (such as jokes based on inappropriate acts), theory of mind, and they may display deficits in comprehending the intention behind a joke (Hoicka, 2016; Samson, 2013). This is thought in part to be due to deficiencies in theory of mind, which is the ability to attribute mental states (e.g., knowledge, emotions, intents and desires) to others and oneself (Atherton et al., 2019). This difference in interpretation of humour between those with and without ASD could relate to the development of gelotophobia. Whilst the ability of individuals to create humour is not related to gelotophobia, gelotophobes tend to evaluate benevolent laughter as hostile, to evaluate playful humour as malevolent (Ruch et al., 2014), and they can be more sensitive to aggression in humour.

Only a small number of studies have investigated the relationship between ASD and gelotophobia (Leader & Mannion, 2020). The first study to investigate gelotophobia in a sample of adults with ASD was by Samson et al. (2011). In the ASD group, 45% of adults were over the gelotophobia threshold, with 27.5%, 10%, and 7.5% of participants over the 'slight', 'marked' and 'extreme' cut-off points respectively. In comparison, only 6% of the typically developed (TD) group were in the 'slight' bracket, with no participants

in the higher brackets. These results were supported by studies conducted since then which found that individuals with ASD were significantly more likely to have gelotophobia than TD controls (Leader et al., 2018; Tsai et al., 2018; Wu et al., 2015).

Several of these studies investigated potential mediators and predictors of the relationship between ASD and gelotophobia. Wu et al. (2015) found that parental attachment to a father figure, but not a maternal figure, was negatively correlated with gelotophobic symptoms in Taiwanese high school students with ASD. It was suggested in future research to also examine peer attachment. Tsai et al. (2018) examined the relationship between the Big Five personality traits and gelotophobia in Taiwanese high school students with ASD. It was demonstrated that the association between ASD and gelotophobia was due to extraversion, as opposed to ASD itself. Leader et al. (2018) reported that social functioning, bullying, anxiety and life satisfaction were predictors of gelotophobia in adults with ASD.

Difficulties with emotional expression, emotional understanding and deficits in humour may predict gelotophobia, and these are all traits associated with ASD. Individuals with ASD can struggle with emotions. Research among TD samples has found links between emotional regulation, which is the ability to manage and regulate one's emotions, and gelotophobia. Weiss et al. (2012) found that participants who had gelotophobia described themselves as less able to regulate their negative emotions than those who did not display gelotophobic symptoms. This relationship has not yet been evaluated in an ASD population, however those with ASD consistently demonstrate heightened maladaptive emotional regulation strategies when compared to TD individuals (Bruggink et al., 2016). Hence, it is feasible that the low emotional regulation abilities and deficits in humour in those with ASD may exacerbate gelotophobia symptomology.

There are some gaps and constraints in the present research on gelotophobia (Grennan et al., 2018). Firstly, there are significantly more male participants in comparison to female participants across the studies. Secondly, only two of the mentioned studies examined an adult sample (Leader et al., 2018; Samson et al., 2011), indicating more research attention in this area is needed. Thirdly, there is evidence to suggest more correlates and predictors should be examined to determine what the risk-factors are for individuals with ASD in developing gelotophobia.

The first aim of the current study is to investigate the relationship between ASD and gelotophobia in a sample of adults. It is hypothesised that adults with ASD will show heightened rates and symptoms of gelotophobia in comparison to TD controls. The second aim of this study is to evaluate the predictors of gelotophobia in participants with and

without ASD. Variables have been chosen from previous research on gelotophobia in ASD and TD samples. These include the following: social functioning, extraversion, emotional regulation, and peer attachment. It is hypothesised that these variables will predict gelotophobia symptoms in adults with and without ASD.

## Method

### Participants

Based on the results of a power analysis conducted in G\*Power v.3.1.9.4, it was determined that a total of 502 participants was needed to detect a small-medium effect, with a power of 0.08 and a two-tailed alpha of 0.05. The ASD group for this study comprised of 230 adults with a diagnosis of ASD ranging from 18 to 68 years. Diagnoses were provided by a psychiatrist or licensed psychologist independent of this study, as reported by participants. The TD control group comprised of 272 adults ranging from 18 to 84 years. The ASD sample was 40.9% male ( $n=94$ ) whereas the control group was 39.7% male ( $n=108$ ).

Participants were not eligible to be included in the TD control group if they had a diagnosis of ASD. Twenty-one participants were removed from the control group as they met the cut-off for ASD as specified by the Autism Spectrum Quotient (AQ-10), which is a measure of autistic traits in adults with normal intelligence. A further two participants were excluded from the control group as they indicated they were in the process of being diagnosed with ASD. Participants in the ASD group had to indicate that they had a formal diagnosis, those with self-reported diagnoses were excluded ( $n=2$ ). In addition, due to the large age range of the sample, two participants in the control group aged >70 years were excluded from the final analytic sample.

### Procedure

Individuals over the age of 18 with and without an ASD diagnosis were recruited through social media, through posters, and from a research participant system for university students in exchange for course credit. Individuals were also made aware of the study through emails sent out to autism research and support groups. If an individual was interested in participating, they were provided with a participant information sheet and consent form. We did not collect information concerning individuals who were recruited but ultimately declined to participate, as informed consent to collect this data was not obtained. Once consent was obtained, informants could fill out the battery of measures below.

## Measures

### Demographic information

A self-constructed demographic questionnaire was included to obtain information on participant's age, gender, diagnosis of ASD, level of education, occupation, and current diagnoses such as depression or anxiety.

### GELOPH <15>

The GELOPH<15> is a 15-item questionnaire designed to measure gelotophobia symptomology subjectively. It contains questions such as "when strangers laugh in my presence, I often relate it to me personally". Answers are displayed on a four-point scale from strongly agree to strongly disagree. An average of the scores is calculated, with a cut-off score of 2.50, 3.00 and 3.50 indicating 'slight', 'marked' and 'extreme' gelotophobia respectively. The GELOPH<15> has demonstrated excellent internal validity, with Cronbach's alpha reported at 0.93 and has been used with ASD samples (e.g. Leader et al., 2018; Murray et al., 2022b). In the present study, the Cronbach alpha coefficient was 0.93.

### Emotional Regulation Questionnaire

The Emotional Regulation Questionnaire (ERQ) is a 10-item scale which measures an individual's ability to regulate their emotions under two facets: (1) Cognitive Reappraisal and (2) Expressive Suppression. Cognitive Reappraisal involves the ability to change one's thoughts and feelings around emotion-eliciting stimuli. Expressive Suppression is a strategy which involves the suppression of an emotion. Participants answered each item on a 7-point Likert scale ranging from strongly disagree to strongly agree. The ERQ has been used to evaluate emotional regulation in ASD samples in the past (e.g. Samson et al., 2012). The psychometric properties have been validated with acceptable to excellent internal consistency scores demonstrated on both Cognitive Reappraisal ( $\alpha=0.89-0.90$ ) and Expressive Suppression ( $\alpha=0.76-0.80$ ) Cronbach's alpha scores were 0.87 for Cognitive Reappraisal and 0.77 for Expressive Suppression in the current study.

### Autism Spectrum Quotient 10-items

The Autism Spectrum Quotient 10-items (AQ-10 Adult; Allison et al., 2012) is a self-report measure of autistic traits in adults with normal intelligence. It contains two items on each domain of ASD symptomology: social interaction, communication, attention to detail, attention switching and

imagination (Booth et al., 2013). Items are answered on a four-point scale from definitely agree to definitely disagree. Internal Consistency for the scale is reported to be good ( $\alpha=0.85$ ; Allison et al., 2012). Cronbach's alpha for the current study was 0.83.

### Social functioning questionnaire

The Social Functioning Questionnaire (SFQ) is an 8-item instrument measuring a person's perception of their social functioning in areas such as work, finance, relationships, sex and hobbies. Items are rated on a four-point scale with scores range from 0 to 24 with higher scores indicating lower social functioning. The SFQ has good inter-rater and test-retest and reliability and has been used in ASD samples previously (e.g. Leader et al., 2018). The alpha score in this study was 0.68.

### Inventory of Parent and Peer Attachment

The Inventory of Parent and Peer Attachment (IPPA) is a self-report construct measuring one's attachment to peers or parents and has been widely used in ASD samples (e.g. Wu et al., 2015). The 25-item peer-attachment subdomain of this scale was used to examine peer-attachment in participants across three areas with alpha scores in the current study as follows; communication ( $\alpha=0.91$ ), trust ( $\alpha=0.95$ ) and alienation ( $\alpha=0.74$ ). Scores are answered on a five-point Likert scale and range from 1 to 5. Test-retest reliability has been reported at 0.86.

### NEO Five-Factor Inventory-3 (extraversion facet)

The NEO-FFI-3 is a modified version of the NEO-FFI-R. It consists of 60 questions across the five personality domains, with 12 items in each domain. The 12-items of the extraversion facet were used in this study as a measure of extraversion, with questions such as "I like to have a lot of people around me". Responses are coded from on a 5-point Likert scale from strongly agree to strongly disagree. The extraversion facet has demonstrated good internal consistency in adult samples with an alpha score of 0.86 and has been used in samples of ASD adults in prior research (e.g., Kanai et al., 2011). In the present study, the alpha score was 0.76.

### Statistical analysis

Pearson's chi-squared tests were conducted to compare diagnoses of psychiatric disorders between the ASD and TD groups. Cramer's  $V$  estimates of effect size were obtained. Independent-samples  $t$ -tests were conducted for each study measure: gelotophobia, autistic traits, social functioning,

peer attachment, extraversion, and emotional regulation between the two groups. To assist with the ordering of the hierarchical regressions, Pearson's correlations were calculated for all variables. To investigate if gelotophobia symptoms were higher in individuals with ASD than in the TD group, a one-way ANOVA was conducted. Following this, two hierarchical multiple regressions were conducted to examine the effect of social functioning, peer attachment, extraversion, and emotional regulation on gelotophobia in both the ASD and TD groups. Independent-samples  $t$ -tests were conducted to compare the ASD and control groups for each study measure: gelotophobia, autistic traits, social functioning, peer attachment, extraversion, and emotional regulation to examine differences between the ASD and the TD group. An independent-samples  $t$ -test was chosen over analysis of covariance (ANCOVA) as even though ANCOVA facilitates the examination of covariates, this tends to come at the cost of reduced statistical power if the covariate does not have a strong relationship with the dependent variable (Miller & Chapman, 2001). A series of moderated mediation analyses were conducted to examine the mediating role of autistic traits on the relationship between gelotophobia and social functioning, cognitive reappraisal, expressive suppression, alienation and extraversion at different levels of the moderator variable of group (ASD/TD).

Pearson's correlations were calculated for all variables to investigate which variables relate with each other. A Bonferroni correction was applied to adjust for multiple correlations. With 45 tests, the alpha level was adjusted to  $p=.001$ . While Bonferroni correction procedures have less power than false discovery rate (FDR) controlling procedures, the Bonferroni correction procedure allows for more rigorous control of Type 1 errors, and as such is more statistically conservative. Based on this, and based on the number of tests included, a Bonferroni correction was chosen as the most appropriate procedure.

## Results

Table 1 presents the demographic information and a breakdown of participant diagnoses from the self-constructed questionnaire gathered for the ASD group and the control group.

A Pearson chi-square test revealed a significant association between gender and AS diagnosis ( $X^2=17.86$ ,  $p<.001$ ,  $V=0.19$ ). Pearson chi-squared tests were conducted to compare diagnoses of psychiatric disorders between the ASD and TD groups. Individuals in the ASD group had significantly more comorbid diagnoses, other than ASD, when compared to the control group, with 80.9% of adults in the ASD group ( $n=186$ ) presenting with at least one comorbid

**Table 1** Overview of participant demographic variables and comparison of comorbid diagnoses between ASD sample and TD sample

Characteristic	ASD ( <i>n</i> =230)		TD ( <i>n</i> =270)		Pearson $\chi^2$	V
	% ( <i>N</i> )	M (SD)	% ( <i>N</i> )	M (SD)		
<i>Age</i>		31.32 (11.03)		28.13 (12.81)		
<i>Gender</i>						
Male	40.9 ( <i>n</i> =94)		40.0 ( <i>n</i> =108)			
Female	48.7 ( <i>n</i> =112)		58.15 ( <i>n</i> =157)			
Other <sup>a</sup>	10.4 ( <i>n</i> =24)		1.85 ( <i>n</i> =5)			
<i>Education</i>						
Primary schooling	2.6 ( <i>n</i> =6)		0.74 ( <i>n</i> =2)			
Secondary schooling	27.0 ( <i>n</i> =62)		37.41 ( <i>n</i> =101)			
Further Education Programme	27.4 ( <i>n</i> =63)		12.22 ( <i>n</i> =33)			
Third level University Degree	28.7 ( <i>n</i> =66)		38.15 ( <i>n</i> =103)			
Master's degree	10.0 ( <i>n</i> =23)		10.37 ( <i>n</i> =28)			
PhD / Doctorate degree	3.0 ( <i>n</i> =7)		1.11 ( <i>n</i> =3)			
Other	1.3 ( <i>n</i> =3)		( <i>n</i> =0)			
<i>Employment Status</i>						
Student	25.7 ( <i>n</i> =59)		51.12 ( <i>n</i> =138)			
Unemployed (cannot or does not want to work)	23.5 ( <i>n</i> =54)		2.22 ( <i>n</i> =6)			
Unemployed (looking for work)	7.4 ( <i>n</i> =17)		3.70 ( <i>n</i> =10)			
Self-employed	7.4 ( <i>n</i> =17)		5.19 ( <i>n</i> =14)			
Home-carer	1.7 ( <i>n</i> =4)		0.74 ( <i>n</i> =2)			
Employed	31.3( <i>n</i> =72)		34.81 ( <i>n</i> =94)			
Retired	1.7 ( <i>n</i> =4)		1.85 ( <i>n</i> =5)			
Other	1.3 ( <i>n</i> =3)		0.37 ( <i>n</i> =1)			
<i>Presence of Diagnosis</i>						
Any Diagnosis	80.9 ( <i>n</i> =186)		32.59 ( <i>n</i> =88)		124.52***	0.50***
Depression	58.7 ( <i>n</i> =135)		16.30 ( <i>n</i> =44)		97.15***	0.44***
Anxiety Disorder	59.1 ( <i>n</i> =136)		31.85 ( <i>n</i> =59)		72.55***	0.38***
Bipolar Disorder	3.0 ( <i>n</i> =7)		2.59 ( <i>n</i> =7)		0.09	0.01
Psychosis	3.5 ( <i>n</i> =8)		( <i>n</i> =0)		9.54**	0.14**
Sleep Disorder	13.0 ( <i>n</i> =30)		3.33 ( <i>n</i> =9)		16.28***	0.18***
Insomnia	7.0 ( <i>n</i> =16)		2.22 ( <i>n</i> =6)			
Difficulties falling/staying asleep	4.3 ( <i>n</i> =10)		( <i>n</i> =0)			
Other sleep disorders <sup>b</sup>	3.9 ( <i>n</i> =9)		1.11 ( <i>n</i> =3)			
OCD	11.7 ( <i>n</i> =27)		2.59 ( <i>n</i> =7)		16.40***	0.18***
AD/HD	23.5 ( <i>n</i> =54)		2.96 ( <i>n</i> =8)		48.12***	0.31***
Tourette's Syndrome	2.6 ( <i>n</i> =6)		( <i>n</i> =0)		7.13**	0.12**
Epilepsy	3.5 ( <i>n</i> =8)		( <i>n</i> =0)		9.76**	0.14**
<i>Gastrointestinal symptoms</i>						
Nausea in the last 3 months	15.2 ( <i>n</i> =35)		4.81 ( <i>n</i> =13)		15.49***	0.18***
Yes	12.2 ( <i>n</i> =28)		2.96 ( <i>n</i> =8)			
No	2.6 ( <i>n</i> =6)		1.85 ( <i>n</i> =5)			
Unsure	0.4 ( <i>n</i> =1)		( <i>n</i> =0)			
Intellectual Disability	2.2 ( <i>n</i> =5)		( <i>n</i> =0)		5.92*	0.11*
PTSD	7.8 ( <i>n</i> =18)		0.37 ( <i>n</i> =1)		18.89***	0.19***

**Table 1** (continued)

Characteristic	ASD ( <i>n</i> =230)		TD ( <i>n</i> =270)		Pearson $\chi^2$	V
	% ( <i>N</i> )	M (SD)	% ( <i>N</i> )	M (SD)		
Personality Disorder	3.5 ( <i>n</i> =8)		1.48 ( <i>n</i> =4)		2.11	0.07
Other Diagnosis <sup>c</sup>	9.6 ( <i>n</i> =22)		2.22 ( <i>n</i> =6)		12.67***	0.16***

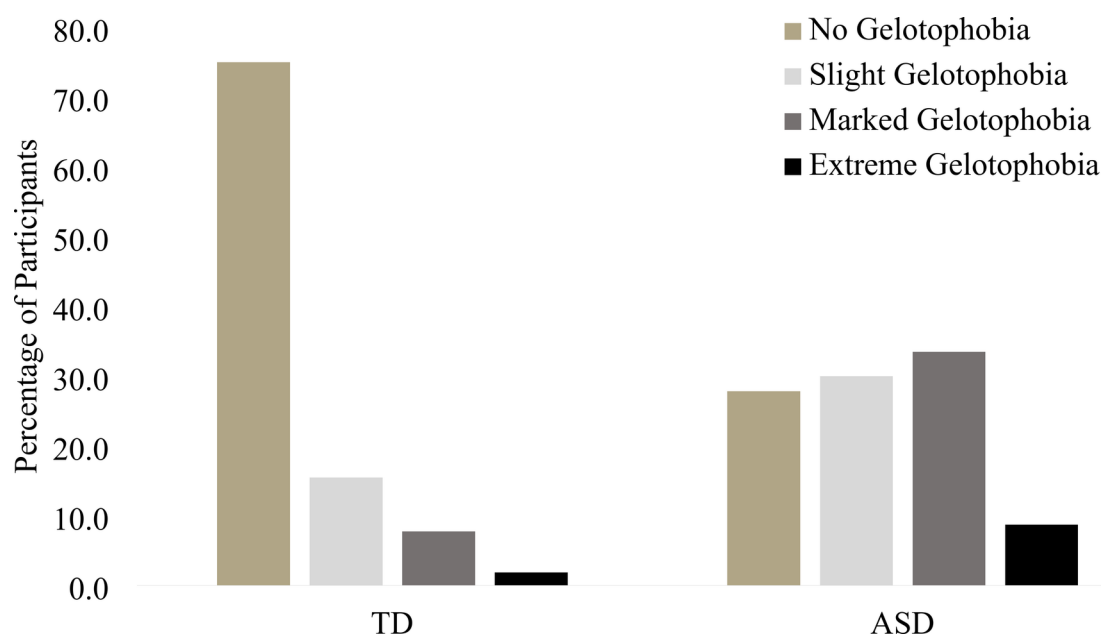
ASD autism spectrum disorder; TD typically developing; OCD obsessive compulsive disorder; ADHD attention deficit hyperactivity disorder; PTSD post-traumatic stress disorder

<sup>a</sup> Other self-described options for gender includes non-binary, genderfluid, gender-neutral, transgender, agender, aspiegendered, demiguy and other

<sup>b</sup> Other sleep disorders include sleep apnea, sleep paralysis, night terrors, parasomnia, narcolepsy, non-24, delayed sleep phase syndrome and anxiety preventing sleep

<sup>c</sup> Other diagnoses include schizophrenia, cerebral palsy, fibromyalgia, arthritis, phobia, pathological demand avoidance, brain damage, pelizaeus-merzbacher disease, addiction, hypermobility, eating disorder, diabetes, dyspraxia, speech hearing disorder, dyscalculia, savant syndrome, vitiligo, chronic fatigue syndrome, dysautonomia, klinefelters syndrome, dyslexia, degenerative disk disease and developmental coordination disorder

\*\*\* $p < .001$ ; \*\* $p < .01$ ; \* $p < .05$



**Fig. 1** Gelotophobia Classification Comparison Between ASD and Control Group

diagnosis in comparison to 32.7% of the control group ( $n=89$ ). Regarding gelotophobia, 72.2% of the ASD group ( $n=166$ ) and 25.0% of the control group ( $n=68$ ) were over the cut-off for having a form of gelotophobia. The percentage of participants over each gelotophobia cut-off point is provided in Fig. 1.

Model 7 of the PROCESS macro (Hayes, 2013) was adopted to test the mediating role of autistic traits on the relationship between gelotophobia and social functioning, cognitive reappraisal, expressive suppression, alienation and extraversion at different levels of the moderator variable of autism group (ASD/TD). It was found that presence of autism did not moderate the relationship between gelotophobia and social functioning ( $B=0.05$ ,  $p=.937$ , 95% CI [-0.12, 0.13]). However, autistic traits were significantly

negatively associated with social functioning ( $B=-0.12$ ,  $p=.02$ , 95% CI [-0.23, -0.02]). Nonetheless, the overall moderated mediation model was not supported by the index of moderated mediation = -0.001, 95% CI [-0.02, 0.02]. It was found that presence of autism did not moderate the relationship between gelotophobia and cognitive reappraisal ( $B=0.01$ ,  $p=.936$ , 95% CI [-0.12, 0.13]). However, autistic traits were significantly negatively associated with cognitive reappraisal ( $B=-0.26$ ,  $p<.001$ , 95% CI [-0.36, -0.15]). Nonetheless, the overall moderated mediation model was not supported by the index of moderated mediation = -0.001, 95% CI [-0.04, 0.04].

Presence of autism did not moderate the relationship between gelotophobia and expressive suppression ( $B=0.01$ ,  $p=.936$ , 95% CI [-0.12, 0.13]). Furthermore, autistic traits

**Table 2** Means and standard deviations of study measures in ASD and TD groups

Variable	ASD			TD			t	Cohen's d	F	p
	N	M	SD	N	M	SD				
Gelotophobia	230	2.81	0.52	270	2.12	0.60	-13.58***	1.23 (large)	184.48	<0.001
Autistic Traits	225	7.75	2.02	270	2.85	1.65	-29.69***	2.66 (large)		
Social Functioning	224	12.00	3.82	270	11.77	4.09	-0.60	0.06 (none)		
Emotional Regulation										
Cognitive Reappraisal	219	23.73	7.80	270	27.39	6.72	5.57***	0.50 (medium)		
Expressive Suppression	219	16.40	5.61	270	14.89	5.46	-3.01**	0.27 (small)		
Extraversion	217	17.46	7.26	270	26.41	6.86	13.95***	1.27 (large)		
Peer Attachment										
Trust	214	36.00	9.51	270	41.03	7.67	6.45***	0.59 (medium)		
Communication	214	26.22	7.53	270	29.43	6.63	4.99***	0.45 (medium)		
Alienation	214	20.03	5.17	270	17.66	4.91	-5.17***	0.47 (medium)		

Gelotophobia measured using GELOPH<15>; Autistic Traits measured using AQ-10; Social Functioning measured using SFQ; Emotional regulation measured using ERQ; Extraversion measured using NEO-FFI-3; Peer attachment measured using IPPA

\*\*\**p*<.001; \*\**p*<.01; \**p*<.05

**Table 3** Pearson correlation matrix for study variables for both ASD and TD groups

	1.	2.	3.	4.	5.	6.	7.	8.	9.
1. Age									
2. Gelotophobia	-0.12**								
3. Autistic symptoms	0.05	0.57**							
4. Social Functioning	0.02	0.24**	0.05						
5. Cognitive Reappraisal	-0.01	-0.27**	-0.33**	-0.20**					
6. Expressive Suppression	-0.12**	0.37**	0.19**	0.12**	-0.07				
7. Extraversion	-0.17**	-0.44**	-0.53**	-0.07	0.23**	-0.25**			
8. Trust	-0.05	-0.36**	-0.33**	-0.31**	0.29**	-0.31**	0.31**		
9. Communication	-0.08	-0.29**	-0.29**	-0.20**	0.32**	-0.37**	0.30**	0.87**	
10. Alienation	-0.11*	0.51**	0.30**	0.35**	-0.20**	0.36**	-0.22**	-0.57**	-0.48**

Gelotophobia measured using GELOPH<15>; autistic symptoms measured using AQ-10; social functioning measured using SFQ; cognitive reappraisal and expressive suppression measured using ERQ; extraversion measured using NEO-FFI-3; trust, communication and alienation measured using IPPA

\*\*\**p*<.001; \*\**p*<.01; \**p*<.05

were not associated with expressive suppression ( $B=-0.26$ ,  $p<.001$ , 95% CI [-0.36, -0.15]). Moreover, the overall moderated mediation model was not supported by the index of moderated mediation= $-0.001$ , 95% CI [-0.01, 0.01]. It was found that presence of autism did not moderate the relationship between gelotophobia and extraversion ( $B=0.01$ ,  $p=.944$ , 95% CI [-0.12, 0.13]). However, autistic traits were significantly negatively associated with extraversion ( $B=-0.41$ ,  $p<.001$ , 95% CI [-0.50, -0.32]). Nonetheless, the overall moderated mediation model was not supported by the index of moderated mediation= $-0.001$ , 95% CI [-0.06, 0.06]. It was found that presence of autism did not moderate the relationship between gelotophobia and alienation ( $B=0.001$ ,  $p=.944$ , 95% CI [-0.12, 0.12]). Furthermore, autistic traits were not associated with alienation ( $B=0.03$ ,  $p=.584$ , 95% CI [-0.07, 0.12]). The overall moderated mediation model was not supported by the index of moderated mediation= $<0.001$ , 95% CI [-0.01, 0.01].

Independent-samples *t*-tests were conducted to compare the ASD and control groups for each study measure: gelotophobia, autistic traits, social functioning, peer attachment, extraversion, and emotional regulation to examine differences between the ASD and the TD group. Significant differences were observed between the groups on all study measures, except for social functioning. Each of the significant differences were in the expected direction. Gelotophobia was higher in individuals with ASD with a large effect size, which aligns with our hypotheses (see Table 2).

Pearson's correlation coefficients revealed that gelotophobia was positively correlated with the expressive suppression facet of emotional regulation, the alienation facet of peer attachment, and social functioning (Table 3). Gelotophobia was negatively correlated with the cognitive reappraisal facet of emotional regulation and the peer attachment domains of trust and communication with small effect sizes.

To investigate if the levels of gelotophobia were higher in individuals with ASD than in the TD group, an

independent-samples *t*-test was conducted. The IV was defined by group with participants divided into the ASD and control group. The DV was gelotophobia. Levene's test for homogeneity of variance was not significant ( $F_{(1, 500)}=3.36$ ,  $p=.067$ ), thus ensuring equal variances [62]. The results of the independent-samples *t*-test revealed a significant difference between the ASD and control group in expressions of gelotophobia reported ( $t_{(498)} = -13.58$ , 95% CI [-0.78, -0.59],  $p < .001$ ). Participants in the ASD group ( $M=2.81$ ,  $SD=0.52$ ) reported significantly higher rates of gelotophobia than participants in the control group ( $M=2.12$ ,  $SD=0.60$ ). These findings are illustrated in Fig. 2.

To investigate if elements of social functioning, peer attachment, extraversion, and emotional regulation contribute to explaining gelotophobia outcomes, two stepwise regressions were conducted for each criterion variable, one for the ASD group and one for the comparison group. The data file was split, and two separate regressions were performed for the two groups. Cases were weighted by age to adjust for the wide age range in the sample. Stepwise regressions were chosen to ascertain if each criterion variable contributed to gelotophobia and to build on the work of Leader et al. (2018). Pearson's correlation statistics for predictor variables were less than 0.9, indicating that multicollinearity was not present in the data. The variance inflation factor (VIF) scores were less than 10 (range=1.01–1.50 (TD); 1.10–1.33 (ASD) and tolerance scores were greater than 0.1 (range 0.75–91 (TD); 0.75 –0.91 (ASD)).

The results of the regression analysis for the TD group can be viewed in Table 4 and show that the overall model was significant, accounting for 37% of the variance in gelotophobia ( $F_{(7, 7594)}=645.08$ ,  $p < .001$ ,  $R^2=0.37$ , adjusted  $R^2=0.37$ ,  $f^2=0.59$ ). Step one, alienation, accounted for 28% of the variance ( $F_{(1, 7593)}=2969.48$ ,  $\Delta R^2=0.28$ , adjusted  $\Delta R^2=0.28$ ,  $\beta=0.53$ ,  $p < .001$ ). The second step with expressive suppression added accounted for 3% of the variance ( $F_{(1, 7592)}=362.93$ ,  $\Delta R^2=0.03$ , adjusted  $\Delta R^2=0.03$ ,  $\beta=0.20$ ,  $p < .001$ ). The third step with cognitive reappraisal added accounted for 2% of the variance ( $F_{(1, 7591)}=261.00$ ,  $\Delta R^2=0.02$ , adjusted  $\Delta R^2=0.02$ ,  $\beta = -0.15$ ,  $p < .001$ ). The fourth step with extraversion accounted for 2% of the variance ( $F_{(1, 7590)}=167.63$ ,  $\Delta R^2=0.02$ , adjusted  $\Delta R^2=0.02$ ,  $\beta = -0.12$ ,  $p < .001$ ). The fifth step with communication added accounted for 1% of the variance ( $F_{(1, 7589)}=111.76$ ,  $\Delta R^2=0.01$ , adjusted  $\Delta R^2=0.01$ ,  $\beta=0.12$ ,  $p < .001$ ) as did the sixth step with trust added ( $F_{(1, 7588)}=140.20$ ,  $\Delta R^2=0.01$ , adjusted  $\Delta R^2=0.01$ ,  $\beta = -0.23$ ,  $p < .001$ ). The seventh and final step with social functioning added accounted for the final 0.1% of the variance ( $F_{(1, 7587)}=12.36$ ,  $\Delta R^2=0.001$ , adjusted  $\Delta R^2=0.001$ ,  $\beta=0.03$ ,  $p < .001$ ).

The results of the regression analysis for the ASD group show that the overall model was significant, accounting for 28% of the variance in gelotophobia ( $F_{(7, 6784)}=373.04$ ,  $p < .001$ ,  $R^2=0.29$ , adjusted  $R^2=0.28$ ,  $f^2=0.39$ ). Step one, expressive suppression, accounted for 15% of the variance ( $F_{(1, 6783)}=1183.06$ ,  $\Delta R^2=0.15$ , adjusted  $\Delta R^2=0.15$ ,  $\beta=0.39$ ,  $p < .001$ ). The second step with social functioning

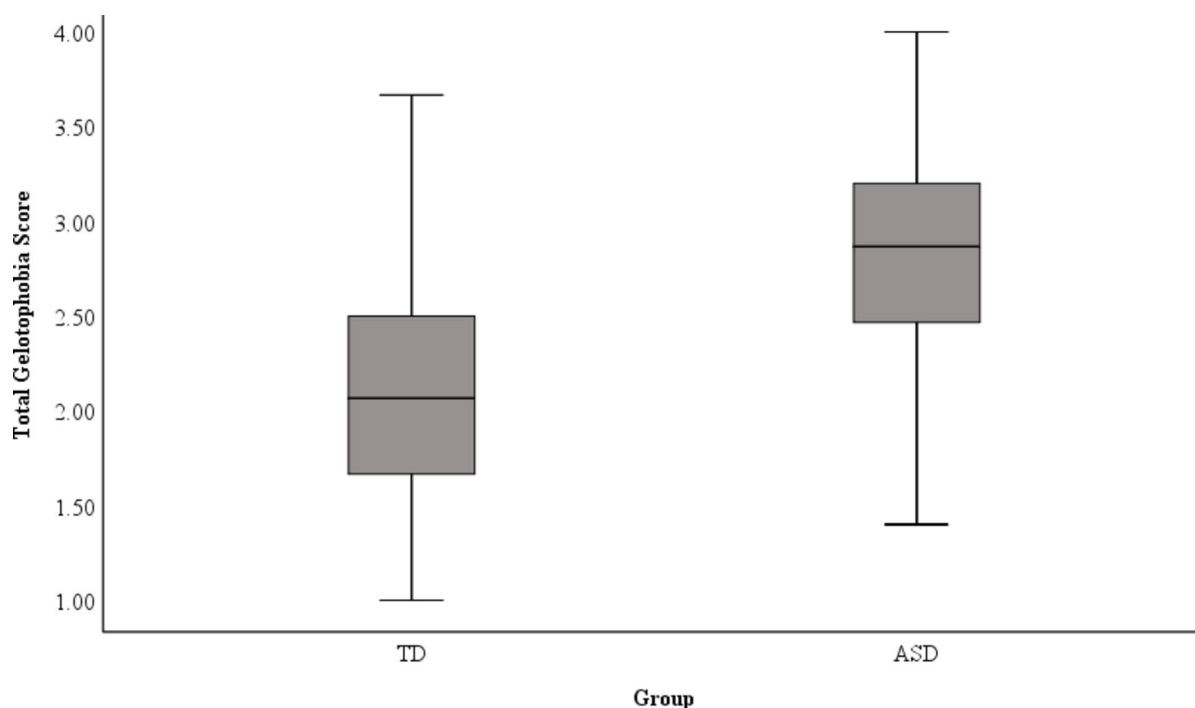


Fig. 2 Boxplot Comparison of Gelotophobia Between ASD and Control group

**Table 4** Summary of Stepwise regression analysis for predictors of gelotophobia in the TD and ASD group

Step	Variable	$\beta$ (final model)	$\Delta R^2$	Adjusted $\Delta R^2$	F-change	F <sup>2</sup>
TD group						
1.	Alienation	.39***	.28	.28	2969.48	.59
2.	Expressive Suppression	.22***	.03	.03	362.93	
3.	Cognitive Reappraisal	-.16***	.02	.02	261.00	
4.	Extraversion	-.13***	.02	.02	167.63	
5.	Communication	.29***	.01	.01	111.76	
6.	Trust	-.21***	.01	.01	140.20	
7.	Social Functioning	.03***	.001	.001	12.36	
ASD group						
1.	Expressive Suppression	.26***	.15	.15	1183.06	.39
2.	Social Functioning	.24***	.09	.08	766.23	
3.	Alienation	.23***	.03	.03	275.70	
4.	Extraversion	-.10***	.01	.01	71.97	
5.	Trust	.06***	.01	.01	32.62	
6.	Cognitive Reappraisal	.04**	.001	.001	11.01	

Total  $R^2=0.37$ , adjusted  $R^2=0.37$  (TD); Total  $R^2=0.29$ , adjusted  $R^2=0.28$  (ASD)

\*\*\* $p<.001$ ; \*\* $p<.01$ ; \* $p<.05$

added accounted for 8% of the variance ( $F_{(1, 6782)}=766.23$ ,  $\Delta R^2=0.09$ , adjusted  $\Delta R^2=0.08$ ,  $\beta=0.30$ ,  $p<.001$ ). The third step with alienation added accounted for 3% of the variance ( $F_{(1, 6781)}=275.70$ ,  $\Delta R^2=0.03$ , adjusted  $\Delta R^2=0.03$ ,  $\beta=0.20$ ,  $p<.001$ ). The fourth step with extraversion added was also a significant contributor, accounting for 1% of the variance ( $F_{(1, 6780)}=71.97$ ,  $\Delta R^2=0.01$ , adjusted  $\Delta R^2=0.01$ ,  $\beta=-0.09$ ,  $p<.001$ ). The fifth step with trust added accounted for 1% of the variance ( $F_{(1, 6779)}=32.62$ ,  $\Delta R^2=0.01$ , adjusted  $\Delta R^2=0.01$ ,  $\beta=0.07$ ,  $p<.001$ ). The sixth and final step with cognitive reappraisal added accounted for the final 0.1% of the variance ( $F_{(1, 6778)}=11.01$ ,  $\Delta R^2=0.001$ , adjusted  $\Delta R^2=0.001$ ,  $\beta=0.04$ ,  $p=.001$ ).

## Discussion

The current study explored the degree of gelotophobia in adults with ASD compared to neurotypical adults. This is the first study to investigate gelotophobia regarding its associations with social functioning, peer attachment, extraversion, and emotional regulation in adults with ASD and how these variables explain the outcome of gelotophobia. As hypothesised, individuals with ASD were significantly more likely to present with heightened gelotophobia with a large effect size, with 72.2% of the ASD and 25.0% of the control group over the cut-off. This is in line with previous research on adults which found 87.4% and 45% of ASD samples and 22.6% and 6.0% of TD samples presented with gelotophobia, respectively (Leader et al., 2018; Samson et al., 2011). There is strong evidence to suggest that individuals with ASD may be more likely to demonstrate

higher levels of gelotophobia (Grennan et al., 2018; Leader & Mannion, 2020).

Elements of extraversion, peer attachment, emotional regulation and social functioning were found to contribute to gelotophobia in both the ASD and TD groups. An individual who scores high in extraversion would be considered sociable and outgoing. Extraversion negatively contributed to gelotophobia in both groups, accounting for a small amount of the variance in gelotophobia. This suggests that being less outgoing or less sociable may be associated with higher expressions of gelotophobia. This builds on previous findings by Tsai et al. (2018) who reported that extraversion mediated the relationship between ASD and gelotophobia. They concluded that extraversion influences the level of gelotophobia as opposed to the groups (ASD and TD). This, paired with our findings, could indicate personality characteristics such as extraversion are correlated with the development of gelotophobia rather than ASD influencing gelotophobia directly. However, inferences concerning cause and effect cannot be made. Furthermore, in the present study extraversion only explained a small amount of the variance in both groups, indicating that other variables may be predicting or mediating this relationship. This is supported by the findings of the moderated mediation analysis, which showed a negative association between autistic traits and extraversion. However, the presence of autism did not moderate the relationship between gelotophobia and extraversion. Therefore, it is possible autistic traits may mediate, rather than moderate, the relationship between gelotophobia and extroversion.

The alienation facet of peer attachment contributed significantly to both models in the expected direction, and it accounted for the largest amount of variance in the control

group (28%). Alienation only accounted for 3% of the variance in the ASD group. This may indicate feeling alienated or estranged from peers may be another factor in gelotophobia development as previously found in TD samples (Wu et al., 2019). However, alienation was found to be a stronger contributor to gelotophobia in the TD group in comparison to the ASD group. It is therefore plausible that alienation may not be a substantial factor in the expression of gelotophobia in individuals with ASD.

The trust facet of peer attachment was not a substantial contributor to either prediction model as it only accounted for 1% of the variance in each group, indicating trust between peers may be unrelated to gelotophobia. Higher levels of trust between peers contributed to greater levels of gelotophobia in the ASD group, whereas lower levels of trust contributed towards increased gelotophobia in the TD group. The communication domain of peer attachment accounted for a small amount of the variance in gelotophobia in the control group but was not a significant contributor in the ASD group. Interestingly, higher communication scores were predictive of higher gelotophobia scores. This is contradictory to previous findings (Wu et al., 2015) which found that lower communication scores were associated with higher levels of gelotophobia traits. This disparity may be explained by the fact that only a miniscule amount of the variance in gelotophobia was explained by communication. Therefore, communication may not be an important factor in gelotophobia outcomes.

Cognitive reappraisal is an emotional regulation strategy involving changing one's interpretation of a given situation to change its emotional impact (McRae et al., 2012). Lessened cognitive reappraisal abilities contributed to gelotophobia in the TD group, whereas higher cognitive reappraisal abilities contributed to gelotophobia in the ASD group. This contradicts previous research which found no link between the two variables (Weiss et al., 2012). In individuals with gelotophobia, one's cognitive reappraisal abilities are skewed towards negative reappraisals, and this can lead to misreading benign social interactions as instances of ridicule (Ruch et al., 2017). Such difficulties with appraising situations in a balanced way can make it difficult for individuals with gelotophobia to cope with social situations, thus contributing to increased emotional dysregulation (Havranek, 2016). Therefore, approaches such as cognitive-behavioural therapy (CBT) may be instrumental in identifying and deconstructing such cognitive distortions, thus reducing the impact of gelotophobia on one's social functioning. The expressive suppression facet of emotional regulation was a significant predictor of gelotophobia in both the TD and ASD groups, but particularly in the ASD group, where it accounted for the largest variance in gelotophobia when compared to the other criterion variables. Expressive

suppression is a maladaptive regulation strategy when an individual inhibits the behaviour of emotional expression (Cai et al., 2018). This would suggest that inhibiting one's emotions in a maladaptive way, may be associated with an increased likelihood of developing gelotophobia in both individuals with ASD and neurotypical individuals.

Lessened social functioning was a significant predictor of gelotophobia in both the ASD and control group, particularly in the ASD group. This may demonstrate that functioning in areas such as work, finance, sex, hobbies, and relationships could potentially influence gelotophobia. In previous research, social functioning was found to be a strong predictor of gelotophobia in a TD and ASD sample, where it accounted for 54% of the variance in gelotophobia (Leader et al., 2018). In the present study it accounted for 8% of the variance in gelotophobia in the ASD group and only 0.1% of the variance in the TD group. Educational level differed between both studies and may be a factor in the impact of social functioning on gelotophobia. Leader et al. (2018) included both ASD and TD participants in the regression whereas the current study separated the ASD and TD groups before conducting the regression. More research is needed to establish what confounding variables may be influencing the conflicting results between both studies. Indeed, it is possible that interpersonal variables such as extraversion or attachment might share variance with social functioning.

It is critical to conduct research in adults with ASD, as most of the current research focuses on children and adolescents (Pellicano et al., 2014). Comorbidity is a serious issue in adults with ASD, and it is important to determine what conditions (both clinical and subclinical) adults with ASD may be more susceptible to. Gelotophobia is an understudied subclinical condition, which has shown to be more prevalent in ASD samples. With more research, preventive strategies and interventions could be designed to impede the development of high expressions of gelotophobia and to mitigate its detrimental effects. For example, interventions could aim to assist individuals to identify playful humorous interactions from disparagement, improve coping strategies, and include fathers, to re-enforce positive aspects of pre-existing relationships (Brauer et al., 2020).

It is noteworthy that gelotophobia is an exceptionally new area in the literature, particularly regarding ASD. Indeed, it has recently been identified as a 'hot topic' in psychology (Bittermann et al., 2021). Hence, gelotophobia in ASD needs to be investigated to discern the prevalence, characteristics, predictors, risk factors and consequences of gelotophobia. This will allow for the development and implementation of specific prevention and intervention strategies for the treatment of gelotophobia in the future. Current research on gelotophobia is largely based on self-reports, hence future research should investigate clinically

diagnosed ASD, as determined in interviews with a psychiatrist or licensed psychologist. The psychologist or psychiatrist could also administer the GELOPH<15> to increase the accuracy of the measure. Only a small number of variables were explored in this study, and it is apparent that other factors are influencing the development of gelotophobia in those with and without ASD. Therefore, the prevalence rates and risk factors for gelotophobia should be further established in both those with and without ASD. Our study did not explore gender and age differences in the expression of gelotophobia in those with ASD, and these differences have not been sufficiently investigated in previous research. Gelotophobia may be influenced by gender and/or age in those with ASD and future research could examine this. Furthermore, it would be useful to investigate if theory of mind interventions, play interventions and communication skills interventions may mitigate the increased risk of developing gelotophobia in those with ASD.

There are some limitations to the present study. Self-report measures may be considered inaccurate and are liable to overestimation. However, previous studies have included parent-report measures, and self-report measures may be advantageous in the current study. Indeed, partner ratings have been found valuable as informant reports in gelotophobia research (Brauer et al., 2020, 2021; Brauer & Proyer, 2020). A second limitation was the use of convenience sampling through online forums, as individuals with gelotophobia may self-select into the study. However, gelotophobia was not mentioned in the research poster to minimise this issue. Thirdly, there were more females than males in both groups in this study, hence the results may not extend to a general demographic. However, research on individuals with ASD generally focuses on males so this could also be viewed as a strength. The majority of ASD participants in this sample would be diagnosed with Level one or Level two support needs, and information related to the ADOS measure and the year in which participants were diagnosed with ASD was not included. Therefore, these results may not be generalisable to the broader population of ASD. In addition, due to the high number of variables entered into the correlation matrix, results should be interpreted with caution due to possible type I errors. This study includes a large age range of participants (18–70 years). Research has suggested older adults may show differences in variables such as social functioning and emotional regulation (Khanjani et al., 2015) which may have influenced the results of this study. In addition, due to the cross-sectional nature of the study, no causal links can be inferred.

## Conclusion

Few studies to date have investigated gelotophobia in adults with ASD. Our study included more females compared to males, which is an advantage over previous research which largely focused on males. Our findings indicate individuals with ASD may indeed be more likely to develop gelotophobia and several potential predictors associated with gelotophobia were highlighted. Expressive suppression and social functioning emerged as the strongest predictors for gelotophobia in the ASD group, indicating that the maladaptive strategy of suppressing emotions and a lack of functioning in various aspects of life may be a risk factor regarding the fear of being laughed at in adults with ASD. This novel research broadens the knowledge and scope in the new and developing area of gelotophobia in those with ASD, and future research could help to determine prevention and intervention strategies to help those with ASD overcome gelotophobic tendencies.

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**Data availability** The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

## Declarations

**Conflict of interest** The authors declare that they have no conflict of interest.

**Ethical approval** Ethical Approval was obtained from the School Research Ethics Committee of the School of Psychology in University of Galway. The study was performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

**Informed consent** Informed consent was obtained from all individual participants included in the study.

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## References

- Allison, C., Auyeung, B., & Baron-Cohen, S. (2012). Toward brief red flags for autism screening: The short autism spectrum quotient and The short quantitative checklist in 1,000 cases and 3,000 controls. *Journal of the American Academy of Child & Adolescent Psychiatry, 51*(2), 202–212.
- American Psychiatric Association. (2022). *Diagnostic and statistical manual of mental disorders, 5th edition: DSM-5-TR*.
- Atherton, G., Lummis, B., Day, S. X., & Cross, L. (2019). What am I thinking? Perspective-taking from the perspective of adolescents with autism. *Autism, 23*(5), 1186–1200.
- Bittermann, A., Batzdorfer, V., Müller, S. M., & Steinmetz, H. (2021). Mining twitter to detect hotspots in psychology. *Zeitschrift Für Psychologie, 229*(1), 3–14.
- Boda-Ujlaky, J. E., & Séra, L. (2016). The relationship between gelotophobia, shame, and humiliation. *The European Journal of Humour Research, 4*(1), 93–101.
- Booth, T., Murray, A. L., McKenzie, K., Kuenssberg, R., O'Donnell, M., & Burnett, H. (2013). Brief report: An evaluation of the AQ-10 as a brief screening instrument for ASD in adults. *Journal of Autism and Developmental Disorders, 43*(12), 2997–3000.
- Brauer, K., & Proyer, R. T. (2020). Gelotophobia in romantic life: Replicating associations with attachment styles and their mediating role for relationship status. *Journal of Social and Personal Relationships, 37*(10–11), 2890–2897.
- Brauer, K., & Proyer, R. T. (2021). Analyzing a German-language expanded form of the PhoPhiKat-45: Psychometric properties, factorial structure, measurement invariance with the Likert-version, and self-peer convergence. *Journal of Personality Assessment, 103*(2), 267–277.
- Brauer, K., Proyer, R. T., & Ruch, W. (2020). Extending the study of gelotophobia, gelotophilia, and katagelasticism in romantic life toward romantic attachment. *Journal of Individual Differences, 41*(2), 86–100.
- Brauer, K., Sendatzki, R., & Proyer, R. T. (2021). Testing the associations between dispositions toward ridicule and being laughed at and romantic jealousy in couples: An APIM analysis. *Journal of Personality, 89*(5), 883–898.
- Bruggink, A., Huisman, S., Vuijk, R., Kraaij, V., & Garnefski, N. (2016). Cognitive emotion regulation, anxiety and depression in adults with autism spectrum disorder. *Research in Autism Spectrum Disorders, 22*, 34–44.
- Cai, R. Y., Richdale, A. L., Foley, K. R., Trollor, J., & Uljarević, M. (2018). Brief report: Cross-sectional interactions between expressive suppression and cognitive reappraisal and its relationship with depressive symptoms in autism spectrum disorder. *Research in Autism Spectrum Disorders, 45*, 1–8.
- Canestrari, C., Arroyo, G. D. M., Carrieri, A., Muzi, M., & Fermani, A. (2021). Parental attachment and cyberbullying victims: The mediation effect of gelotophobia. *Current Psychology, 42*, 16401–16412.
- Canestrari, C., Carrieri, A., Del Moral, G., Fermani, A., & Muzi, M. (2023). Do coping strategies and the degree of satisfaction with one's social life and parental attachment modulate gelotophobia, gelotophilia and katagelasticism? A study on young Italian adults. *Current Psychology, 1*–12.
- Edwards, K. R., Martin, R. A., & Dozois, D. J. (2010). The fear of being laughed at, social anxiety, and memories of being teased during childhood. *Psychological Test and Assessment Modeling, 52*(1), 94.
- Footy, C., James, J. E., & Leader, G. (2014). Parenting stress, salivary biomarkers, and ambulatory blood pressure in mothers of children with autism spectrum disorders. *Research in Autism Spectrum Disorders, 8*(2), 99–110.
- Grennan, S., Mannion, A., & Leader, G. (2018). Gelotophobia and high-functioning autism spectrum disorder. *Review Journal of Autism and Developmental Disorders, 5*(4), 349–359.
- Havranek, M. M. (2016). Characterizing emotion regulation deficits in psychiatric disorders using psychophysiological, neurobiological, and genetic methods. (Doctoral dissertation, University of Zurich).
- Havranek, M. M., Volkart, F., Bolliger, B., Roos, S., Buschner, M., Mansour, R., Chmielewski, T., et al. (2017). The fear of being laughed at as additional diagnostic criterion in social anxiety disorder and avoidant personality disorder? *PLoS One, 12*(11), e0188024.
- Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. The Guilford Press.
- Hoicka, E. (2016). Understanding of humorous intentions. In L. Ruiz-Gurillo (Ed.) *Metapragmatics of humor: Current research trends* (pp. 257–270). John Benjamins Publishing Company. <https://doi.org/10.1075/ivitra.14>
- Kanai, C., Iwanami, A., Hashimoto, R., Ota, H., Tani, M., Yamada, T., & Kato, N. (2011). Clinical characterization of adults with Asperger's syndrome assessed by self-report questionnaires based on depression, anxiety, and personality. *Research in Autism Spectrum Disorders, 5*(4), 1451–1458.
- Khanjani, Z., Mosanezhad Jeddi, E., Hekmati, I., Khalilzade, S., Etemadi Nia, M., Andalib, M., & Ashrafian, P. (2015). Comparison of cognitive empathy, emotional empathy, and social functioning in different age groups. *Australian Psychologist, 50*(1), 80–85.
- Leader, G., & Mannion, A. (2016). Challenging behaviors. In J. L. Matson (Ed.), *Handbook of assessment and diagnosis of autism spectrum disorder* (pp. 209–232). Springer.
- Leader, G., & Mannion, A. (2016). Gastrointestinal disorders. In J. L. Matson (Ed.), *Comorbid Conditions Among Children with Autism Spectrum Disorders* (pp. 257–281). Springer.
- Leader, G., & Mannion, A. (2020). Gelotophobia and Autism. In F. R. Volkmar (Ed.), *Encyclopedia of autism spectrum disorders* (2nd ed.). Springer: In Press. <https://doi.org/10.1007/978-1-4614-643-5-8>
- Leader, G., Grennan, S., Chen, J. L., & Mannion, A. (2018). An investigation of gelotophobia in individuals with a diagnosis of high-functioning autism spectrum disorder. *Journal of Autism and Developmental Disorders, 48*(12), 4155–4166.
- Lugo-Marín, J., Magán-Maganto, M., Rivero-Santana, A., Cuellar-Pompa, L., Alviani, M., Jenaro-Rio, C., Diéz, E., & Canal-Bedia, R. (2019). Prevalence of psychiatric disorders in adults with autism spectrum disorder: A systematic review and meta-analysis. *Research in Autism Spectrum Disorders, 59*, 22–33.
- Maenner, M. J., Warren, Z., Williams, A. R., et al. (2023). Prevalence and characteristics of autism spectrum disorder among children aged 8 years—Autism and developmental disabilities monitoring network, 11 sites, united States, 2020. *MMWR Surveillance Summaries, 72*, 1–14.
- Matson, J. L., & Cervantes, P. E. (2014). Commonly studied comorbid psychopathologies among persons with autism spectrum disorder. *Research in Developmental Disabilities, 35*(5), 952–962.
- McRae, K., Ciesielski, B., & Gross, J. J. (2012). Unpacking cognitive reappraisal: Goals, tactics, and outcomes. *Emotion, 12*(2), 250.
- Miller, G. A., & Chapman, J. P. (2001). Misunderstanding analysis of covariance. *Journal of Abnormal Psychology, 110*(1), 40.
- Murray, A., Koronczai, B., Király, O., Griffiths, M. D., Mannion, A., Leader, G., & Demetrovics, Z. (2022a). Autism, problematic internet use, and gaming disorder: A systematic review. *Review Journal of Autism and Developmental Disorders, 9*, 120–140.

- Murray, A., Mannion, A., Chen, J. L., & Leader, G. (2022b). Gaming disorder in adults with autism spectrum disorder. *Journal of Autism and Developmental Disorders*, *52*, 2762–2769.
- Pellicano, E., Dinsmore, A., & Charman, T. (2014). What should autism research focus upon? Community views and priorities from the united Kingdom. *Autism*, *18*(7), 756–770.
- Pexman, P. M., Rostad, K. R., McMorris, C. A., Climie, E. A., Stowkowy, J., & Glenwright, M. R. (2011). Processing of ironic Language in children with high-functioning autism spectrum disorder. *Journal of Autism and Developmental Disorders*, *41*(8), 1097–1112.
- Platt, T., Ruch, W., & Proyer, R. T. (2010). A lifetime of fear of being laughed at: An aged perspective. *Zeitschrift Für Gerontologie Und Geriatrie*, *43*(1), 36–41.
- Ruch, W., Hofmann, J., Platt, T., & Proyer, R. (2014). The state-of-the Art in gelotophobia research: A review and some theoretical extensions. *Humor*, *27*, 23–45.
- Ruch, W., Platt, T., Brunsch, R., & Ďurka, R. (2017). Evaluation of a picture-based test for the assessment of gelotophobia. *Frontiers in Psychology*, *8*, 2043.
- Samson, A. C. (2013). Humor (lessness) elucidated—Sense of humor in individuals with autism spectrum disorders: Review and introduction. *Humor*, *26*(3), 393–409.
- Samson, A. C., Huber, O., & Ruch, W. (2011). Teasing, ridiculing and the relation to the fear of being laughed at in individuals with Asperger's syndrome. *Journal of Autism and Developmental Disorders*, *41*(4), 475–483.
- Samson, A. C., Huber, O., & Gross, J. J. (2012). Emotion regulation in Asperger's syndrome and high-functioning autism. *Emotion*, *12*(4), 659.
- Tsai, M. N., Wu, C. L., Tseng, L. P., An, C. P., & Chen, H. C. (2018). Extraversion is a mediator of gelotophobia: A study of autism spectrum disorder and the big five. *Frontiers in Psychology*, *9*, 150.
- Watkins, L., Kuhn, M., Ledbetter-Cho, K., Gevarter, C., & O'Reilly, M. (2017). Evidence-based social communication interventions for children with autism spectrum disorder. *The Indian Journal of Pediatrics*, *84*(1), 68–75.
- Weiss, E. M., Schuler, G., Freudenthaler, H. H., Hofer, E., Pichler, N., & Papousek, I. (2012). Potential markers of aggressive behavior: The fear of other person's laughter and its overlaps with mental disorders. *PLoS One*, *7*, e38088.
- Wu, C. L., An, C. P., Tseng, L. P., Chen, H. C., Chan, Y. C., Cho, S. L., & Tsai, M. L. (2015). Fear of being laughed at with relation to parent attachment in individuals with autism. *Research in Autism Spectrum Disorders*, *10*, 116–123.
- Wu, C. L., Liu, Y. R., Kuo, C. C., Chen, H. C., & Chang, Y. L. (2016). Effectiveness of humor training among adolescents with autism. *Psychiatry Research*, *30*(246), 25–31.
- Wu, C. L., Huang, Y. T., Wang, P. Y., & Chen, H. C. (2019). Parent-child attachment as a mediator of the relationship between parenting style and gelotophobia among adolescents. *International Journal of Psychology*, *54*(4), 548–556.

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