The psychological impact of COVID-19 among a sample of Italian individuals with High Functioning Autism Spectrum Disorder

Veronica Nisticò

Università degli studi di Milano

Orsola Gambini

Università degli studi di Milano

Raffaella Faggioli

A.O. San Paolo, ASST Santi Paolo e Carlo

Benedetta Demartini (✉ benedettademartini@gmail.com)

Università degli studi di Milano

Short Report

Keywords: High Functioning Autism Spectrum Disorder, SARS-CoV-2, COVID-19, Lockdown, Social Isolation, Stress response

Posted Date: July 22nd, 2020

DOI: <https://doi.org/10.21203/rs.3.rs-47184/v1>

License: This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Version of Record: A version of this preprint was published at Journal of Clinical Neuroscience on July 22nd, 2020. See the published version at <https://doi.org/10.1016/j.jocn.2021.11.026>.

Abstract

Aim of this study was to assess the prevalence of stress, anxiety, depression and symptoms related to post-traumatic stress disorder (PTSD) across a sample of 45 adult subjects with High Functioning Autism Spectrum Disorder (HF-ASD) during the first two months of COVID-19 pandemic in Italy, with respect to a sample of 45 healthy controls (HC). We also explored some specific aspects of their psychological well-being through an ad-hoc questionnaire. Our results showed subjects with HF-ASD to have higher rates of depression, anxiety, stress and PTSD related symptoms than HC during the first two months of COVID-19 pandemic. However, subjects with HF-ASD, with respect to HC, reported to feel subjectively more comfortable and less tired during the lockdown than before.

Introduction

Also defined as Asperger syndrome in the tenth revision of the International Statistical Classification of Diseases and Related Health Problems (ICD10) and in the fourth revised edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR), High Functioning Autism Spectrum Disorder (HF-ASD) is a disorder characterized by deficits in social interaction, specific or repetitive patterns of behaviors or interests and verbal or nonverbal communication difficulties in the absence of intellectual disability or cognitive impairment (Intelligence Quotient > 70) (Ameli et al. 1988). Although HF-ASD is often misdiagnosed or unrecognized and its prevalence is arguably underestimated, especially in adults, its impact on subjects' global functioning is often severe and symptoms commonly interfere with both individuals' and caregivers' quality of life (Kamp-Becker et al. 2010; Grootscholten et al. 2018). Subjects with HF-ASD have often difficulties interpreting what other people are thinking or feeling, understanding and regulating their own emotions, interpreting others' facial expressions, body language, or social cues and maintaining the natural give-and-take of a conversation (Koyama et al. 2007). It is clear how these difficulties might negatively influence the global functioning of individuals with HF-ASD, especially in areas related to work activity and sociality where interpersonal interactions are required (Baldwin et al. 2014). The frequent lack of a proper diagnosis, along with the lack of specific support and services in the areas of relationships, social care, community integration, education and employment often lead people with HF-ASD to experience severe symptoms of anxiety when they are obliged to face social situations, such as work environment (Bejerot et al. 2014). Concerning this aspect, research studies showed that patients with HF-ASD perform better in environments where they can work alone with a high degree of autonomy in a clearly defined and intellectually challenging job. In contrast, work settings that are highly variable from day-to-day and require teamwork and interaction with colleagues are the most challenging to secure or maintain for individuals with HF-ASD (Hensel 2017).

During the last three months most of the countries of the world has started to fight their battle against coronavirus disease 2019 (COVID-19) pandemic. The battle is arguably still ongoing and is not limited to the physical consequences of the disease, but also included the psychological and social effects of the pandemic itself and of its subsequent strict preventive measures ordered by government authorities to try to contain the outbreak. Recent studies showed how levels of stress, anxiety and depression have greatly

increased since the beginning of the outbreak, especially in elderly people, healthcare workers and individuals with a preexistent psychiatric condition (Li et al. 2020, Wang et al. 2020, Moccia et al. 2020). Moreover, people with intellectual disabilities and behavioral problems (such as individuals affected by Autism Spectrum Disorder) struggle with respecting rules and habits that are not always understandable for them, with the consequence of feeling more agitated and irritated (Chow et al. 2020; Eshraghi et al. 2020 Narzisi 2020). Local mental health services have rapidly reorganized themselves in order to optimize care for people with and without a history of mental illness (D'Agostino et al. 2020). However, no published research to date has explored the psychological impact of the COVID-19 outbreak and of its subsequent lockdown in selected samples of subjects with psychiatric or neuropsychiatric conditions. Aim of the present study was to assess the prevalence of specific psychiatric symptoms (stress, anxiety, depression and symptoms related to post-traumatic stress disorder (PTSD)) across a sample of adult subjects with HF-ASD during the first two months of COVID-19 pandemic in Italy, with respect to a sample of healthy controls. We also explored some specific aspects of their psychological well-being through an ad-hoc questionnaire designed for the study.

Methods

This study had a cross-sectional design and used a survey online to administer questionnaires to subjects with HF-ASD and healthy controls (HC). Forty-five adult subjects with HF-ASD were recruited from the tertiary level outpatient clinic of ASST Santi Paolo e Carlo, Presidio San Paolo in Milan. Subjects with HF-ASD were diagnosed by a psychiatrist and a psychologist according to DSM-5 criteria (A.P.A. 2013). To further confirm the diagnosis, all subjects underwent the Module 4 of the Autism Diagnostic Observation Schedule – 2nd version (ADOS-2), Module 4 (Hus & Lord 2014), which is a reliable semi structured diagnostic tool, based on interviewer's clinical observation. Specifically, Module 4 is validated for adults and adolescents with fluent language. Forty-five healthy controls were recruited amongst the general population through a snowball sampling strategy. The HC "healthy state" was determined through a specifically designed anamnestic interview, including questions on current medical history and the administration of the clinical interview Structured Clinical Interview for DSM-5 (SCID-5) (First & Williams, 2016). Exclusion criteria were: (i) age less than 18 years old; (ii) presence of intellectual disabilities (Intelligence Quotient < 70), measured via the Wechsler Adult Intelligence Scale - Fourth Edition (WAIS-IV) (Lang et al. 2015); (iii) psychotic disorders. Data collection took place between 4th May and 8th May 2020. All participants signed an online written informed consent form before completing the questionnaire. The study was approved and revised by the ASST Santi Paolo e Carlo Ethics Committee. Through the online questionnaire, demographic information was collected including age, gender, employment status and place of work before and during lockdown. The survey included the following questionnaires: (i) The Depression, Anxiety and Stress Scale – 21 items (DASS-21), a validated self-report questionnaire, assessing depressive and anxiety symptoms (Henry & Crawford 2005). A Total Score was calculated as an index of general distress; moreover, the following three subscale scores were calculated: Stress, Anxiety, and Depression. According to each subscale score, participants were labelled on a severity scale. Specifically, the subscale Stress score was divided into 0-7 (normal), 8-9 (mild), 10-12

(moderate), 13-16 (severe) and ≥ 17 (extremely severe); the subscale Anxiety score was divided into 0-3 (normal), 4-5 (mild), 6-7 (moderate), 8-9 (severe) and ≥ 10 (extremely severe); the subscale Depression score was divided into 0-4 (normal), 5-6 (mild), 7-10 (moderate), 11-13 (severe) and ≥ 14 (extremely severe). (ii) The Impact of Event Scale-Revised (IES-R), a 22-item self-report scale that assesses subjective distress caused by traumatic events (Christianson et al. 2012). The IES-R Total Score, obtained by summing the answers to each item, was divided into 0–23 (normal), 24–32 (mild psychological impact), 33–36 (moderate psychological impact), and >37 (severe psychological impact). Moreover, three subscales were calculated, providing an indication of the level of distress experienced: Intrusion, Avoidance and Hyperarousal; (iii) The Perceived Stress Scale (PSS), a 10-item validated instrument to measure “the degree to which situations in one’s life are appraised as stressful” (Cohen et al. 1983). Each item is rated on a 5-point Likert scale, ranging from 0 (never) to 4 (very often). Total scores range from 0 to 40, with higher scores indicating higher levels of perceived stress. Scores ranging from 0 to 13 would be considered low stress, from 14 to 26 moderate stress, from 27 to 40 high perceived stress. Participants were also asked to complete an ad hoc questionnaire designed for the study including the following questions to be answered on a 7-point Likert scale: (i) how tired did you feel when you arrived at the end of your study/work day the month before the lockdown, on a scale from 1 to 7 (where 1 = not tired at all and 7 = extremely tired)? (ii) how tired have you felt at the end of your study/work day since the lockdown has started, on a scale from 1 to 7 (where 1 = not tired at all and 7 = extremely tired)? (iii) how much do you think your lifestyle has changed since the lockdown has started, on a scale from 1 to 7 (where 1 = not changed at all and 7 = extremely changed)? (iv) how your psychological well-being has been influenced by the measures ordered by Italian authorities to contain the COVID-19 outbreak, which implied a clear decrease in social interactions, on a scale from 1 to 7 (where 1 = I feel less comfortable than before and 7 = I feel more comfortable than before)? (v) how much in the past two months did you try to make contact again via social media or on the phone with people with whom you had not had contact for several months or with whom you had lost contact, on a scale from 1 to 7 (where 1 = less than before the lockdown, and 7 = more than before the lockdown)? From the above mentioned ad hoc questionnaires we extrapolated the following variables: (i) Tiredness_pre lockdown; (ii) Tiredness_lockdown; (iii) Lifestyle_lockdown; (iv) Psychological_wellbeing_lockdown; (v) Old contacts_lockdown.

Statistical analysis

Statistical analysis was performed using SPSS version 26 (Statistical Package for Social Science).

First, descriptive statistics were calculated for sociodemographic characteristics and for scales score.

T-test for independent sample was run to assess differences between groups at the sociodemographic variables and at the psychometric assessment; degrees of freedom reflect the Greenhouse-Geisser correction where sphericity was violated, according to Levene’s test. Categorical variables were analysed via Pearson Chi Square (χ^2) test. Moreover, levels of tiredness before and during the lockdown were analysed via Repeated Measure ANOVA, with “Tiredness” as within subject variable (two levels:

Tiredness_pre lockdown and Tiredness_lockdown, as above) and “Group” as between subject factor. The significance level was set at $\alpha = 0.05$, and all tests were 2-tailed.

Results

There was no significant difference between the two groups in terms of age ($t(88) = 0.919$, $p = 0.361$) and gender ($\chi^2(2) = 1.692$, $p = 0.429$). In particular, in our sample, within the HF-ASD group 15 subjects (33.3%) were female (ratio F : M = 1 : 1.93), and one participant per group declared a non-binary gender. None of the participants was affected by COVID-19. Complete sociodemographic information is reported in Table 1.

Significant differences emerged between the two groups at the DASS-21 Total Score ($t(59.24) = -4.452$, $p < 0.001$) and at all the DASS-21 subscales: Stress ($t(66.859) = -2.335$, $p = 0.023$); Anxiety ($t(58.791) = -3.342$, $p = 0.001$); and Depression ($t(55.476) = -5.763$, $p < 0.001$), all with subjects with HF-ASD scoring higher than HC. Subjects with HF-ASD scored higher than HC also at the IES-R Total Score ($t(62.209) = -6.15$, $p = 0.004$) and at all the IES-R subscales: Avoidance ($t(72.699) = -5.888$, $p < 0.001$); Intrusion ($t(55.789) = -5.063$, $p < 0.001$); and Hyperarousal ($t(65.011) = -5.441$, $p < 0.001$). Moreover, Subjects with HF-ASD reported significantly higher scores than HC at the PSS ($t(71.019) = -5.44$, $p < 0.001$).

There was a significant difference between groups at the following variables: (i) Lifestyle_lockdown ($t(88) = 2.606$, $p = 0.011$), with HC reporting a higher perceived change of their lifestyle during the lockdown, than individuals with HF-ASD; (ii) Psychological_wellbeing_lockdown ($t(78.348) = -5.544$, $p < 0.001$), with individuals with HF-ASD reporting to feel more comfortable during the lockdown period, in relation to the social distancing measures adopted by Italian authorities, with respect to HC; (iii) Old contacts_lockdown ($t(77.854) = 3.345$, $p = 0.001$), with HC trying more often than individuals with HF-ASD to contact old acquaintances during the lockdown period. Moreover, repeated measures ANOVA showed that there was a significant main effect of the within-subject variable Tiredness ($F(1, 88) = 9.136$, $p = 0.003$), no main effect of Group ($F(1, 88) = 2.234$, $p = 0.139$), and a significant Tiredness*Group interaction effect ($F(1, 88) = 5.64$, $p = 0.020$): subjects with HF-ASD only reported to arrive at the end of their study/work day significantly less tired during the lockdown than during the month before the lockdown (Figure 1).

Discussion And Conclusion

This study, designed to explore the prevalence of psychiatric symptoms and specific aspects of psychological well-being across a sample of adult subjects with HF-ASD during the first two months of COVID-19 pandemic in Italy, with respect to a sample of healthy controls, showed that subjects with HF-ASD presented significantly higher levels of stress, anxiety, depression and symptoms related to post-traumatic stress disorder than healthy controls. This result is consistent with previous literature showing that subjects with HF-ASD present significantly higher rates of anxiety and depression than healthy controls (Mattila et al. 2010). Moreover, higher levels of perceived stress have already been underlined in

individuals with HF-ASD and seem to correlate with poorer quality of life (Bishop-Fitzpatrick et al. 2018). Recently, also symptoms related to PTSD have been found to be higher in individuals with HF-ASD than the general population (Rumball et al. 2020). The higher prevalence of psychiatric symptoms in subjects with HF-ASD might have multiple explanations: first, a biological vulnerability might predispose these individuals to develop comorbid psychiatric symptoms; second, in some cases, anxiety and depression might be part of the HF-ASD clinical phenotype itself and might not be the expression of a separate comorbid psychiatric disorder; third, environmental factors and stressful events, such as the lack of social support or the elevated anxiety and stress levels among family members of subjects with HF-ASD, might have a crucial role in the development of psychiatric symptoms (Mazzone et al. 2012). Thus, it is not surprising that in the present study we found higher rates of depression, anxiety, stress and PTSD related symptoms in a sample of HF-ASD than in a sample of healthy controls during the first two months of the COVID-19 pandemic, an extraordinary event that might be considered a severe stressful event or even a traumatic event. In fact, concerning this point, Mazzone et al recently showed that a broader range of life events, such as bullying, bereavement, and traumas relating to mental health problems (e.g. breakdowns) appear to be experienced as traumatic and may act as a catalyst for PTSD development in adults with ASD (Mazzone et al. 2012). On the other hand, it is quite surprising that the rates of the explored psychiatric symptoms in our sample of individuals with HF-ASD are not higher than the rates found in previous studies which explored the same symptoms in individuals with HF-ASD independently from the pandemic condition (Bishop-Fitzpatrick et al. 2018; Mattila et al. 2020; Mazzone et al. 2012; Rumball et al 2020). As recent studies found in the general population (Gao et al. 2020; Zhang et al. 2020), in fact, we would have expected a higher prevalence of these symptoms also in individuals with HF-ASD during the outbreak and lockdown period, when compared to pre-epidemic rates. To try to explain this discrepancy, the results obtained through the ad hoc questionnaire administered to our sample of participants, exploring specific aspects of psychological well-being, might help. In fact, our data also showed that individuals with HF-ASD, with respect to healthy controls, reported to feel subjectively more comfortable during the lockdown period than before, in relation to the social distancing measures ordered by Italian authorities to contain the COVID-19 outbreak, which implied a clear decrease in social interactions (e.g. finding fewer people on the street or in the supermarket, hearing less traffic noise, implementing smart working, etc.). Moreover, subjects with HF-ASD, but not HC, reported to arrive at the end of their study/work day significantly less tired during the lockdown than during the month before the lockdown (Figure 1). These data are intriguing, since they seem to show that subjects with HF-ASD, with respect to healthy controls, somehow benefit from the lockdown, in terms of feeling more comfortable with the social distancing measures and feeling less tired than before the lockdown at the end of the day. This result, along with the fact that we did not find an increased prevalence of psychiatric symptoms in subjects with HF-ASD during the lockdown period when compared to results of studies conducted in pre-epidemic times, might be explained by some intrinsic clinical features of the HF-ASD itself, such as the difficulty in social interaction and the feeling of perceiving themselves as different from the majority of other people. In this view, the lockdown might represent a situation where subjects with HF-ASD manage to represent themselves as more similar to others, experiencing the same situation and facing the same difficulties. They might even be able to handle social isolation and social distancing better than the

general population because they have often had to deal with social isolation during their entire lives (Barendse et al. 2018). This hypothesis is further corroborated by the fact that subjects with HF-ASD reported a lower perceived change of their lifestyle during the lockdown than HC and they tried less often than HC to contact old acquaintances during the lockdown period.

This study has the following limitations; first, although we compared our results with the ones of previous studies assessing the prevalence of psychiatric symptoms in other samples of patients with HF-ASD in pre-epidemic times, we did not have a pre-lockdown psychometric assessment of our own sample; second, the use of an online survey did not allow to explain study objectives directly and to debrief the participants.

In conclusion, our study showed subjects with HF-ASD to have higher rates of depression, anxiety, stress and symptoms related to PTSD than the general population during the first two months of COVID-19 pandemic in Italy. However, the prevalence of these symptoms in subjects with HF-ASD was not higher than the one found in previous studies assessing the same symptoms in subjects with HF-ASD before the pandemic. Moreover, subjects with HF-ASD, with respect to healthy controls, reported to feel subjectively more comfortable during the lockdown period than before, in relation to the social distancing measures, and to arrive at the end of their study/work day significantly less tired during the lockdown than during the month before the lockdown.

References

Ameli, R., Courchesne, E., Lincoln, A., Kaufman, A. S., & Grillon, C. (1988). Visual memory processes in high-functioning individuals with autism. *Journal of Autism and Developmental Disorders*, 18(4), 601-615. doi: 10.1007/BF02211878.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (DSM-5®). American Psychiatric Pub.

American Psychiatric Association (2000) *Diagnostic and Statistical Manual of Mental Disorders*, 4th edition, American Psychiatric Association, Washington, DC, USA.

Baldwin, S., Costley, D., & Warren, A. (2014). Employment activities and experiences of adults with high-functioning autism and Asperger's disorder. *Journal of Autism and Developmental Disorders*, 44(10), 2440-2449.

Barendse, E. M., Hendriks, M. P., Thoonen, G., Aldenkamp, A. P., & Kessels, R. P. (2018). Social behaviour and social cognition in high-functioning adolescents with autism spectrum disorder (ASD): two sides of the same coin?. *Cognitive processing*, 19(4), 545-555.

Bejerot, S., Eriksson, J. M., & Mörtberg, E. (2014). Social anxiety in adult autism spectrum disorder. *Psychiatry research*, 220(1-2), 705-707.

- Bishop-Fitzpatrick, L., Mazefsky, C. A., & Eack, S. M. (2018). The combined impact of social support and perceived stress on quality of life in adults with autism spectrum disorder and without intellectual disability. *Autism*, 22(6), 703-711.
- Chow, N., Fleming-Dutra, K., Gierke, R., Hall, A., Hughes, M., Pilishvili, T., et al. (2020). Preliminary estimates of the prevalence of selected underlying health conditions among patients with coronavirus disease 2019 –United States, February 12–March 28, 2020. *Morbidity and Mortality Weekly Report*, 69(13), 382.
- Christianson, S., & Marren, J. (2012). The impact of event scale-revised (IES-R). *Medsurg Nurs*, 21(5), 321-322.
- Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of health and social behavior*, 385-396.
- D'Agostino, A., Demartini, B., Cavallotti, S., & Gambini, O. (2020). Mental health services in Italy during the COVID-19 outbreak. *The Lancet Psychiatry*, 7(5), 385-387.
- Eshraghi, A. A., Li, C., Alessandri, M., Messinger, D. S., Eshraghi, R. S., Mittal, R., & Armstrong, F. D. (2020). COVID-19: overcoming the challenges faced by individuals with autism and their families. *The Lancet Psychiatry*, 7(6), 481-483.
- First, M. B., Williams, J. B., Karg, R. S., & Spitzer, R. L. (2016). *SCID-5-CV: structured clinical interview for DSM-5 disorders, clinician version*. American Psychiatric Association Publishing.
- Gao, J., Zheng, P., Jia, Y., Chen, H., Mao, Y., Chen, S., et al (2020). Mental health problems and social media exposure during COVID-19 outbreak. *Plos one*, 15(4), e0231924.
- Grootscholten, I. A., van Wijngaarden, B., & Kan, C. C. (2018). High functioning autism spectrum disorders in adults: Consequences for primary caregivers compared to schizophrenia and depression. *Journal of autism and developmental disorders*, 48(6), 1920-1931. (2018) doi.org/10.1007/s10803-017-3445-1
- Henry, J. D., & Crawford, J. R. (2005). The short-form version of the Depression Anxiety Stress Scales (DASS-21): Construct validity and normative data in a large non-clinical sample. *British journal of clinical psychology*, 44(2), 227-239.
- Hensel, W. F. (2017). People with autism spectrum disorder in the workplace: An expanding legal frontier. *Harv. CR-CLL Rev.*, 52, 73.
- Hus, V., & Lord, C. (2014). The autism diagnostic observation schedule, module 4: revised algorithm and standardized severity scores. *Journal of autism and developmental disorders*, 44(8), 1996-2012.
- Kamp-Becker, I., Schröder, J., Remschmidt, H., & Bachmann, C. J. (2010). Health-related quality of life in adolescents and young adults with high functioning autism-spectrum disorder. *GMS Psycho-Social-Medicine*, 7. doi: 10.3205/psm000065

- Koyama, T., Tachimori, H., Osada, H., Takeda, T., & Kurita, H. (2008). Cognitive and symptom profiles in Asperger's disorder and high-functioning autism. *Seishin shinkeigaku zasshi= Psychiatria et neurologia Japonica*, 110(6), 469.
- Lang, M., Michelotti, C., & Bardelli, E. (2015). *WAIS-IV Wechsler Adult Intelligence Scale-IV: lettura dei risultati e interpretazione clinica* (pp. 1-317). Raffaello Cortina Editore srl.
- Li, Z., Ge, J., Yang, M., Feng, J., Qiao, M., Jiang, R., et al. (2020). Vicarious traumatization in the general public, members, and non-members of medical teams aiding in COVID-19 control. *Brain, behavior, and immunity*.
- Mattila, M. L., Hurtig, T., Haapsamo, H., Jussila, K., Kuusikko-Gauffin, S., Kielinen, M., et al. (2010). Comorbid psychiatric disorders associated with Asperger syndrome/high-functioning autism: a community-and clinic-based study. *Journal of autism and developmental disorders*, 40(9), 1080-1093.
- Mazzone, L., Ruta, L., & Reale, L. (2012). Psychiatric comorbidities in asperger syndrome and high functioning autism: diagnostic challenges. *Annals of general psychiatry*, 11(1), 16.
- Moccia, L., Janiri, D., Pepe, M., Dattoli, L., Molinaro, M., De Martin, V., et al. (2020). Affective temperament, attachment style, and the psychological impact of the COVID-19 outbreak: an early report on the Italian general population. *Brain, behavior, and immunity*.
- Narzisi, A. (2020). Handle the autism spectrum condition during Coronavirus (COVID-19) stay at home period: Ten tips for helping parents and caregivers of young children. *Brain Sci.* 10(4), 207; <https://doi.org/10.3390/brainsci10040207>
- Rumball, F., Happé, F., & Grey, N. (2020). Experience of Trauma and PTSD Symptoms in Autistic Adults: Risk of PTSD Development Following DSM-5 and Non-DSM-5 Traumatic Life Events. *Autism Research*.
- Wang, C., Pan, R., Wan, X., Tan, Y., Xu, L., Ho, C. S., & Ho, R. C. (2020). Immediate psychological responses and associated factors during the initial stage of the 2019 coronavirus disease (COVID-19) epidemic among the general population in China. *International journal of environmental research and public health*, 17(5), 1729.
- World Health Organization (1992) *International Classification of Diseases*, Tenth Revisions, Criteria for Research, WHO, Geneva, Switzerland.
- Zhang, J., Lu, H., Zeng, H., Zhang, S., Du, Q., Jiang, T., & Du, B. (2020). The differential psychological distress of populations affected by the COVID-19 pandemic. *Brain, behavior, and immunity*.

Tables

Table 1

		HF-ASD	HC	p
Age, mean (SD)		37.5 (13.2)	40.2 (14.7)	0.361
gender, N (%)	M	29 (64.4)	23 (51.1)	0.429
	F	15 (33.3)	21 (46.7)	
	Non binary	1 (2.2)	1 (2.2)	
ADOS-2 Communication, mean (SD)		4.4 (2.1)	N/A	N/A
ADOS-2 Reciprocal social interaction, mean (SD)		7.9 (3.4)	N/A	N/A
ADOS-2 Imagination/Creativity, mean (SD)		1.5 (0.7)	N/A	N/A
ADOS-2 Stereotyped behaviours and restricted interests, mean (SD)		1.3 (1.1)	N/A	N/A
ADOS-2 Social communication Total, mean (SD)		12.2 (4.9)	N/A	N/A
Activity_before_lockdown, N (%)	High school student,	2 (4.4)	1 (2.2)	N/A
	University student,	9 (20)	2 (4.4)	
	Working mostly away from home,	22 (48.9)	27 (60)	
	Working mostly from home,	7 (15.6)	8 (17.8)	
	Unoccupied	4 (8.9)	3 (6.7)	
	Retired	1 (2.2)	4 (8.9)	
Activity_lockdown, N (%)	Working mostly away from home,	5 (11.1)	3 (6.7)	N/A
	Working mostly from home,	29 (64.4)	34 (75.6)	
	Unoccupied	11 (24.4)	8 (17.8)	
Tiredness_pre lockdown, mean (SD)		5.1 (1.6)	4.1 (1.6)	0.003 (main effect)
Tiredness_lockdown, mean (SD)		4 (2)	4 (1.8)	
Lifestyle_lockdown, mean (SD)		4.6 (1.7)	5.4 (1.4)	0.011
Psychological_wellbeing_lockdown, mean (SD)		4.7 (1.9)	2.8 (1.3)	< 0.001
Old contacts_lockdown, mean (SD)		3.6 (1.8)	4.6 (1.2)	0.001
DASS-21 Total Score, mean (SD)		19.3 (13.9)	9.2 (5.9)	< 0.001
DASS-21 Stress, mean (SD)		7.6 (5.5)	5.4 (2.9)	0.023
DASS-21 Stress, N (%)	Normal	26 (57.8)	34 (75.6)	N/A
	Mild	4 (8.9)	8 (17.8)	
	Moderate	8 (17.8)	3 (6.7)	
	Severe	3 (6.7)	0	
	Extremely severe	4 (8.9)	0	
DASS-21 Anxiety, mean (SD)		3.5 (4.2)	1.2 (1.7)	0.001
DASS-21 Anxiety, N (%)	Normal	30	39	N/A

		(66.7)	(86.7)	
	Mild	5 (11.1)	5 (11.1)	
	Moderate	3 (6.7)	1 (2.2)	
	Severe	3 (6.7)	0	
	Extremely severe	4 (8.9)	0	
DASS-21 Depression, mean (SD)		8.2 (6.1)	2.6 (2.2)	< 0.001
DASS-21 Depression, N (%)	Normal	15 (33.3)	38 (84.4)	N/A
	Mild	6 (13.3)	2 (4.4)	
	Moderate	10 (22.2)	5 (11.1)	
	Severe	2 (6.7)	0	
	Extremely severe	11 (24.4)	0	
IES-R Total Score, mean (SD)		25.7 (16.4)	9.1 (7.6)	0.004
IES-R Total Score, N (%)	Normal	23 (51.1)	42 (93.3)	N/A
	Mild psychological impact	4 (8.9)	2 (4.4)	
	Moderate psychological impact	4 (8.9)	1 (2.2)	
	Severe psychological impact	14 (31.1)	0	
IES-R Avoidance, mean (SD)		1.1 (0.7)	0.4 (0.4)	< 0.001
IES-R Intrusion, mean (SD)		1.1 (0.9)	0.4 (0.3)	< 0.001
IES-R Hyperarousal, mean (SD)		1.3 (0.9)	0.5 (0.4)	< 0.001
PSS, mean (SD)		22.3 (8.1)	14.6 (4.7)	< 0.001
PSS, N (%)	Low stress	6 (13.3)	18 (40)	N/A
	Moderate stress	27 (60)	27 (60)	
	High stress	12 (26.7)	0	

Table 1. Sociodemographic and psychometric data for HF-ASD and HC. Abbreviations: ADOS-2 = Autism Diagnostic Observation Schedule – 2nd version, DASS-21 = Depression, Anxiety and Stress Scale – 21 items; HF-ASD = High Functioning Autism Spectrum; HC = Healthy controls; IES-R = Impact of Event Scale-Revised; N = Numerosity; PSS = Perceived Stress Scale; SD = Standard Deviation; N/A = Not Applicable

Declarations

Ethics

All participants signed an online written informed consent form before completing the questionnaire. The study was approved and revised by the ASST Santi Paolo e Carlo Ethics Committee. Through the online

questionnaire, demographic information was collected including age, gender, employment status and place of work before and during lockdown.

Competing Interests

The authors declare no competing interests

Figures

Figure 1

Self-rated levels of tiredness before and during lockdown, reported by subjects with HF-ASD and HC. Abbreviations: HF-ASD = High Functioning Autism Spectrum Disorder; HC = Healthy controls.