The Associations of Sensory Processing and Quality of Life Among Children with Autism Spectrum Disorder in Klang Valley, Malaysia

Wirdahayu MS[1], Siti Fairuz binti Ismail[1], Sethu Murugan[2], Rashid MA[3], Mohammed Shahjahan Kabir[4], Tan Yong Chia[5], Shaker UA[6], Tania I[7], Theingi MM[8], Rajesh Thangarajan[4], Farzana Y[9], Saeid Reza Doustjalali[10], Negar Shafiei Sabet[10], Nathan V[1], Hardev Singh HS[2], Nazmul MHM[2] and *Lubna Shirin[11]

[1]School of Occupational Therapy, Perdana University, Damansara Heights, 50490 Kuala Lumpur, Malaysia
[2]School of Medicine and Health Sciences, Perdana University, Damansara Heights, 50490 Kuala Lumpur, Malaysia
[3]Faculty of Medicine, AIMST University, Bedong,08100, Kedah, Malaysia
[4]International Medical School, Management and Science University, Shah Alam 40100, Selangor, Malaysia
[5]Department of Clinical Medicine, Advanced Medical and Dental Institute, University Sains Malaysia, Bertam 13200 Kepala Batas, Penang, Malaysia
[6]Department of Psychiatry, Faculty of Medicine, Manipal University College Malaysia, Melaka, Malaysia
[7]Department of Surgery, Faculty of Medicine, University of Malaya, Kuala Lumpur, Malaysia
[8]Community Based Department, UniKL, RCMP, 30450 Ipoh, Perak, Malaysia
[9]Faculty of Science, Lincoln University, Petaling Jaya, Selangor, Malaysia
[10]Faculty of Medicine, SEGi University, Kota Damansara, Selangor, Malaysia
[11]Department of Anatomy, Faculty of Medicine, Universiti Teknologi MARA, Jalan Hospital, Sungai Buloh, 47000 Selangor, Malaysia
*Corresponding author: Lubna Shirin

ABSTRACT
Sensory processing disorder (SPD) has an impact on the quality of life (QoL) of children with autism spectrum disorder (ASD), affecting their well-being, daily functioning and health. Poor QoL can negatively impact self-esteem, performance, social skills, communication skills, and play skills. The study aims to identify the association between SPD and QoL among ASD children in Malaysia. A cross-sectional study in Malaysia evaluated the health-related quality of life of 100 children with autism spectrum disorder aged 5-7, using a socio- demographic questionnaire, the Short Sensory Profile, and Pediatric QoL Inventory. The short sensory profile (SSP) had 38 items in seven subscales, while PedsQoL had 23 items in four subscales, with higher scores indicating better outcomes. The results showed that most of the participants having definite differences sensory processing disorder in "taste". Also, there are no differences in quality of life among ASD children despite their ages and genders. However, it shows that there are differences in QoL average and SSP category. Non-parametric tests were used due to non- normal data distribution. The study challenges common beliefs about the link between sensory processing disorder, age, gender, and quality of life in children with ASD. It recommends personalized intervention strategies and expanding the sample size while addressing non-normal data distributions and being transparent about ethical considerations.

Keywords
Sensory processing, quality of life, autism spectrum disorder, Sensory processing disorder, short sensory profile

INTRODUCTION

Autism Spectrum Disorder (ASD) is a neurological developmental disorder characterized by abnormalities in social relationships and repetitive or restricted behavioural patterns. Children with ASD often have difficulty processing sensory information, which is the functional registration and interpretation of sensory input from the environment (Costa-Lopez, 2021). This process helps the brain acquire, organize, and react to sensory input in a meaningful and specific way, and children with sensory processing issues may give atypical responses to stimuli like touch, movement, noise and sight. Sensory Processing Disorder (SPD) affects children's learning, behavior, coordination, and language by causing inappropriate responses to sensory inputs. It may also lead to stress, anxiety, depression, and psychopathology.

It is crucial to monitor the quality of life among children to determine changes due to environmental factors (Wallander & Koot, 2016). Children with SPD struggle to process sensory information, which can impede their ability to function effectively in daily life. According to Jovellar-Isiegas (2020), difficulties in sensory processing will restrict children with SPD from participating in daily life activities. This will result in lowering the SPD children's QoL substantially as they may have difficulties engaging in learning and playing. Chien et al. (2016) found that learning, coordination, behavior, language, sensorimotor development, and daily life activities can be affected by SPD. Sensory processing issues, like sensitivity to sensory input, could lead to lower quality of life in several domains including physical, cognitive, emotional, and social (Engel-Yeger, 2012). Hyposensitivity or low sensitivity of sensory processing also could have a bad impact on the level of QoL. Sinclair et al. (2019) found that individuals with hyposensitivity have a lower HRQoL, particularly in emotional and mental aspects.

To date, there are many studies investigated the correlation between sensory processing and QoL, however, they seemed to be more interested in studying about the adults with ASD compared to children with autism spectrum disorder. Also, to our knowledge, most of the studies done were outdated and out from Malaysia. Therefore, this study aimed to determine the quality of life (QoL) of children with ASD in Malaysia and the socio-demographic factors affecting it (Costa-Lopez, 2021). Research suggests that sensory processing disorders can negatively impact QoL among children with ASD. While many studies have focused on the QoL of caregivers, there is a lack of information on the QoL of ASD children themselves in Malaysia. Poor QoL could have adverse effects on their self-esteem, performance, social, communication, and play skills.

METHODOLOGY

This study was using a cross-sectional study design with a quantitative approach. This study recruited 103 participants. However, three potential participants have to be rejected due to different clinical diagnostic. This study's population were children with ASD aged 5-7 years old in Lembah Klang. Data for a survey was collected through two sets of questionnaires converted into Google Forms and distributed to participants via email and WhatsApp. The estimated time to complete the survey was 20 minutes and the duration was 3-4 months. The

socio-demographic questionnaire consists of gender, age, race, religion, marital status, area of living, and child's information on type of disabilities.

The Short Sensory Profile (SSP) is a shortened assessment tools of Dunn's Sensory Profile caregiver questionnaire (Dunn, 2014). It is commonly used in research and clinical settings to measure sensory processing abnormalities in children with and without ASD. The SSP contains 38 items that has been categorized into seven subscales respectively: tactile sensitivity (7 items), taste/smell sensitivity (4 items), movement sensitivity (3 items), under responsive/seeks sensation (7 items), auditory filtering (6 items), low energy/weak (6 items), and visual/auditory sensitivity (5 items). All items are rated using 5-point Likert scale based on the frequency of the described behavior as (1 = Always; 2 = Frequently; 3 = Occasionally; 4 = Seldom; 5 = Never). The lower the score, shows more signs of sensory difficulties, which also indicates, greater severity of sensory problems, and vice versa. Cronbach's coefficient alpha, range from α = 0.82–0.89 in the sample of 117 children used have been reported to investigate the reliabilities of the SSP subscales.

Pediatric Quality of Life Inventory (PedsQoL) is a child and parents report developed by James W Varni. The PedsQoL consisted of 23 items which been categorized into 4 subscales; Physical Functioning (8 items), Emotional Functioning (5 items), Social Functioning (5 items), and School Functioning (5 items). All items score using 3-point Likert scales: 0 (Not at all), 2 (Sometimes), and 4 (A lot). Higher scores indicated better health-related quality of life (HRQoL). The consistency reliability of PedsQoL with alphas of generic score scales are greater than 0.70 and approaching 09.0.

RESULTS

Table 1 shows a demographic overview of the participants involved in this study. This demographic breakdown provides a clear overview of the characteristics of the participants, offering valuable contextual information for the study's interpretation and generalization of findings. This study consisted of male, n=83(83.0%) and female, n=17(17.0%) with age 5 years old, n=32 (32.0%), 6 years old, n=44 (44.0%), and 7 years old, n=24 (24.0%). The participant who answers the questionnaire were mostly Mother, n=63, (63.0%), followed by father, n=37 (37.0%). The majority of participant were Malay, n=74, (74%), followed by Chinese, n=17, (17.0%), Indian, n=8, (8.0%) and others, n=1, (1.0%).

Table 1: Demographic of participants

Category	Frequency (*f*)	Percent (%)
Children's information		
Age		
5 years old	32	32.0
6 years old	44	44.0

7 years old	24	24.0
Gender		
Male	83	83.0
Female	17	17.0
Parents' information		
Mother	63	63.0
Father	37	37.0
Race		
Malay	74	74.0
Chinese	17	17.0
Indian	8	8.0
Other	1	1.0
Religion		
Islam	75	75.0
Buddha	14	14.0
Hindu	8	8.0
Christian	3	3.0

The level of sensory processing disorder among children with ASD

Table 2 presents a descriptive analysis of the level of sensory processing disorder among children diagnosed with ASD. The data is categorized into three levels which are typical performance, probable difference and definite difference. The frequency and percentage distribution are presented for level of sensory processing among child with ASD. This study shows most of the children tend to have definite performance, N=48, (48.0%) on sensory processing disorder, followed by typical performance, N=35, (35.0%), probable different, N=17, (17.0%).

Table 2: Descriptive analysis of the level of sensory processing disorder among autism spectrum disorder children

Category	Frequency (*f*)	Percent (%)

Typical performance	35	35.0
Probable difference	17	17.0
Definite difference	48	48.0

Table 3 shows the sensory processing was classified into 7 sensory dimensions including tactile, taste, movement, under responsive, auditory, low energy and visual. This detailed breakdown provides valuable insights into the specific sensory dimensions where children with ASD may experience challenges, enabling more targeted and effective interventions based on individual sensory needs.

Table 3: Descriptive analysis of the level of sensory processing disorder among autism spectrum disorder children according to sensory dimension

Sensory Dimension	Typical Performance		Probable Performance		Definite Performance	
	f	%	*f*	%	*f*	%
Tactile	23	23.0	44	44.0	33	33.0
Taste	49	49.0	9	9.0	42	42.0
Movement	52	52.0	22	22.0	26	26.0
Under responsive	44	44.0	19	19.0	37	37.0
Auditory	49	49.0	18	18.0	33	33.0
Low energy	58	58.0	24	24.0	18	18.0
Visual	71	71.0	13	13.0	16	16.0
Total	35	35.0	17	17.0	48	48.0

The table above mention about the frequency and percentage distribution, are presented for level of sensory processing among child ASD by each area of sensory. This study shows most of the children tend to have taste sensory, N=42, (42.0%) issues than visual, N=16, (16.0%). Meanwhile, most of the children with ASD have typical performance on visual, N=71, (71.0%), followed by, low energy N=58, movement N=52, (52.0%), taste N=49, (49.0%), auditory N=49, (49.0%), under responsive N=44, (44.0%) and taste, N=23, (23.0%).

The association between age and gender of children with ASD with the QoL

Normality test

Based on Shapiro-Wilk, test of normality, the data of QoL was not normally distributed among ASD in the group of age and gender, with $p<0.05$. Therefore, further analysis of the QoL and its associations with age was conducted using Kruskal-Wallis Test while the association of QoL with gender was conducted using the Whitney U Test. The result indicates 7 years old data ($p = .006$), age 6 years old data ($p = .000$) and 5 years old data ($p= .005$). While for gender, male data ($p = .000$), and female data ($p = .007$).

The quality of life among children with ASD based on age group

Table 4 show the quality of life among ASD and children's age. Based on the Kruskal-Wallis test, the results indicate non-significant difference, $\chi2(2) = 3.38$, $p = .184$. Therefore, can conclude that there is no difference in the QoL average among children with ASD with 5 years old, 6 years old and 7 years old.

Table 4: The QoL among children with ASD and children's Age

	Children's age	N	Mean Rank	Kruskal-Wallis H	df	p
QoL Average Among children with ASD	5 years old	32	50.36	3.38	2	.184
	6 years old	44	45.80			
	7 years old	24	59.31			

The quality of life among children with ASD based on gender group

Table 5 presents a descriptive analysis of the duration of male and female. The variables analyzed include QoL average. For male, the minimum total is 18.48 and the maximum is 81.52, M±SD (44.54±19.62). It is found that female total minimum was 16.30 and maximum total were 71.74, M±SD (43.99±21.40) involved in this study.

Table 5: Descriptive statistic of children's gender

Children's gender	N	Mean	SD	Minimum	Maximum
Male	83	44.54	19.62	18.48	81.52
Female	17	43.99	21.40	16.30	71.74

Table 6 using the Mann-Whitney U test to evaluate whether QoL average among children with ASD differed by male and female.

The results indicated that there was no significant difference between the QoL average among children with ASD differed by male and female, z = .25 p = .81.

Table 6: The QoL among children with ASD and children's gender

	Children's gender	N	Mean Rank	Sum of Ranks	Z	p
QoL Average Among children with ASD	Male	83	50.83	4218.50	-.25	.81
	Female	17	48.91	831.50		

The association between gender of children with ASD with the QoL

Normality test

Based on Shapiro-Wilk, test of normality, the data of QoL was not normally distributed among children with ASD in the group of SSP category, with $p<0.05$. Therefore, to analyse the significant difference in quality of life was conducted using Kruskal-Wallis test. The results indicate that we accept the alternative hypothesis for typical performance data (p = 0.000), probable different data (p = .006) and definite different (p = .001).

Table 7: Normality test of SSP category

SSP Category	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Typical performance	.373	35	.000	.646	35	.000
Probable different	.264	17	.003	.834	17	.006

SSP Category	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Definite different	.105	48	.200*	.910	48	.001

*. This is a lower bound of the true significance.

To determine between the level of sensory processing disorder and quality of life among autism spectrum disorder children aged 5-7 years old

A Kruskal-Wallis test was conducted to determine whether there is a significant difference of SSP category on the QoL Average Among children with ASD. The results indicate significant difference, $\chi 2(2) = 28.96$, $p = .001$. We, therefore, accept the null hypothesis and conclude that there is a difference in the QoL Average Among children with ASD and SSP category.

Table 8: The QoL among children with ASD and children's age

	SP Category	N	Mean Rank	Kruskal-Wallis H	df	p
QoL Average Among ASD	Typical performance	35	33.37	28.96	2	.001
	Probable different	17	40.50			
	Definite different	48	66.53			

DISCUSSION

Firstly, this study examined the level of SPD among children with ASD. The results indicated that among children with ASD, most of them had definite sensory processing challenges. These findings are similar to other numerous studies that stated the prevalence of sensory processing difficulties in the general population increases, by ranges from 5% to 16.5%, with higher estimates observed in clinical populations such as children with ASD and ADHD (Ahn et al., 2004; Ben-Sasson et al., 2009; Lane et al., 2010; Tomcheck et al., 2007). Galiana-Simal et al, (2019) reported that, in 2016, the prevalence of sensory processing disorder among children with ASD ranged between 69% to 93%. Notably, at least 90% of these children experience moderate sensory processing disorder, significantly impacting their roles both as children and students.

Next, this study also determines the effect of age and gender towards QoL of children with ASD. This study concludes that children's age and gender do not significantly affect QoL averages among children with ASD. There is no apparent association between age and the quality of life among children with ASD which shows notable findings with implications for our understanding of the developmental trajectory of individuals with ASD. Vos (2010) suggests a potential association between increased age and diminished QoL in children with severe developmental disabilities, challenging assumptions that advancing age inevitably corresponds to improved QoL. It implies that factors associated with aging or the developmental trajectory of severe disabilities may present challenges that impact overall well-being negatively. Furthermore, the lack of a clear relationship between age and quality of life in these children challenges preconceived notions and highlights the complexity of ASD. No significant

association between gender and the quality of life among children with ASD in the current study is a noteworthy finding that challenges conventional assumptions about the impact of gender on the well-being of individuals with ASD. Historically, research in various fields has explored gender differences in neurodevelopmental disorders, and the absence of a clear link in this study prompts a re-evaluation of the factors contributing to the quality of life for children with ASD. Lastly, based on the findings of this study, it can be concluded that there is indeed a difference in the QoL average among children with ASD when categorized by SSP category. These findings highlight the influence of the SSP category on the QoL of children with ASD. The non-normal distribution of data in different SSP categories suggests that sensory processing challenges play a significant role in shaping the well-being of children with ASD.

CONCLUSION

A study of 126 children aged 5 to 6 revealed their demographic characteristics, outdoor play habits, and social- emotional development. On average, children played outside for 4.6 hours per day, with differences between genders and age groups. Malay children spent more time outdoors than Chinese children. However, the study did not find a significant correlation between the duration of outdoor play and social-emotional development, suggesting other factors may play a more significant role. A study suggested that parental teaching and environment might affect more on social-emotional child. The study prompts a shift towards a more holistic understanding of ASD, fostering a person- centred perspective that recognizes the unique experiences and adaptive strategies of individuals within the spectrum.

REFERENCES

Ahn R. R., Miller L. J., Milberger S., & McIntosh D. N. (2004). Prevalence of parents' perceptions of sensory processing disorders among kindergarten children. American Journal of Occupational Therapy, 58, 287–293.

Ben-Sasson A., Hen L., Fluss R., Cermak S. A., Engel-Yeger B., Gal E. A meta-analysis of sensory modulation symptoms in individuals with autism spectrum disorders. Journal of Autism and Developmental Disorders. 2009;39(1):1–11. doi: 10.1007/s10803-008-0593-3

Chien C. W., Rodger S., Copley J., Branjerdporn G., & Taggart C. (2015). Sensory Processing and Its Relationship with Children's Daily Life Participation. Physical & Occupational Therapy In **https://doi:10.3109/01942638.2015.1040573**

Costa-López B., Ferrer-Cascales R., Ruiz-Robledillo N., Albaladejo-Blázquez N., & Baryła-Matejczuk M. (2021). Relationship between Sensory Processing and Quality of Life: A Systematic Review. Journal Of Clinical Medicine, 10(17), 3961. **https://doi.org/10.3390/jcm10173961**

Dunn W. (2014). Sensory Profile 2. User's manual. Bloomington: Pearson.

Engel-Yeger B. (2012). Validating the Adolescent/Adult Sensory Profile and examining its ability to screen sensory processing difficulties among Israeli people. British Journal of Occupational Therapy, 75(7), 321-329.

Galiana-Simal A., Vela-Romero M., Manuel Romero-Vela V., Oliver-Tercero N., García-Olmo V., Javier Benito-Castellanos P., & MuñozMartinez V., & Beato Fernandez L. (2019). Sensory processing disorder: Key points of a frequent alteration in

neurodevelopmental disorders. Cogent Medicine, 7(1), 1736829. https://doi.org/10.1080/2331205X.2020.1736829

Jovellar-Isiegas P., Resa Collados I., Jaén-Carrillo D., Roche-Seruendo L., & Cuesta García C. (2020). Sensory Processing, Functional Performance and Quality of Life in Unilateral Cerebral Palsy Children: A Cross-Sectional Study. International Journal Of Environmental Research And Public Health, 17(19), 7116. https://doi.org/10.3390/ijerph17197116

Lane S. J., Reynolds S., Thacker L. Sensory over-responsivity and ADHD: Differentiating using electrodermal responses, cortisol, and anxiety. Frontiers in Integrative Neuroscience. 2010;4(8) doi: 10.3389/fnint.2010.00008

Sinclair C., Meredith P., Strong J., & Chalkiadis G. A. (2019). Sensory modulation. The Clinical Journal of Pain, 35(2), 121-132.

Tomchek S., & Dunn W. (2007). Sensory Processing in Children with and Without Autism: A Comparative Study Using the Short Sensory Profile. The American Journal of Occupational https://doi.org/10.5014/ajot.61.2.190

Vos P., Cock P. D., Petry K., Noortgate W.V. D., & Maes B. (2010) What Makes them Feel Like they Do? Investigating the Subjective Well-Being in People with Severe and Profound Disabilities. Research in Developmental Disabilities 31, 1623–32.

Wallander J. L., & Koot H. M. (2016). Quality of life in children: A critical examination of concepts approaches issues and future directions. Clinical psychology review, 45, 131-143.