Quantifying Loudness Sensitivity in Children & Adolescents with Autism Spectrum Disorder

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BACKGROUND

1) Clinical observations reveal children with Autism Spectrum Disorder (ASD) display hyper-sensitivity to loud sounds, causing them distress (Khalfa et al., 2004)
2) Hyperacusis affects at least 40% of children with ASD (Rimland & Edelson, 1995)
3) The Acceptable Noise Level Test (ANL) measures the level of background noise listeners can accept while listening to speech (Gordon-Hickey & Morlas, 2015)
4) Results from the ANL could inform clinical recommendations and education accommodations that pertain to individual noise level tolerances
5) Research on the influence of sex and race on ANL scores in children has been limited

RESEARCH QUESTIONS

1) Do children with ASD differ from their typically developing peers on the ANL?
2) Are ANL scores in children influenced by sex and race?
3) Is parent report of children's loudness sensitivity associated with children's ANL scores?

METHODS

1) Participants included twenty children with ASD and twenty typically developing children aged 10 to 14 years
2) Parents of children with ASD completed the Social Communication Questionnaire (SCQ) to use as a measure of severity of ASD
3) Data was collected on age, sex, and race of the participants
4) Audiologic testing included otoscopy, speech recognition thresholds, pure-tone air- and bone-conduction thresholds, word recognition, tympanometry and otoacoustic emissions.
5) The ANL was measured twice on each child as follows:
   a) Speech was presented through an audiometer to determine participants' most comfortable listening level (MCL)
   b) Speech and background noise were presented simultaneously to find participants' background noise level (BNL)
   c) The two levels (MCL and BNL) were subtracted from one another to find participants' ANL score
6) Parents rated their child's sensitivity to loud sounds on a 1 to 5 scale (1 being the least sensitive, 5 being the most sensitive)
7) Results were analyzed via independent t-tests and Spearman's rho (r_s) to assess differences and associations

	Male/Female	Caucasian/African American
Children with ASD	17/3	20/0
Typically Developing Children	14/6	15/5
Total	31/9	35/5

RESULTS

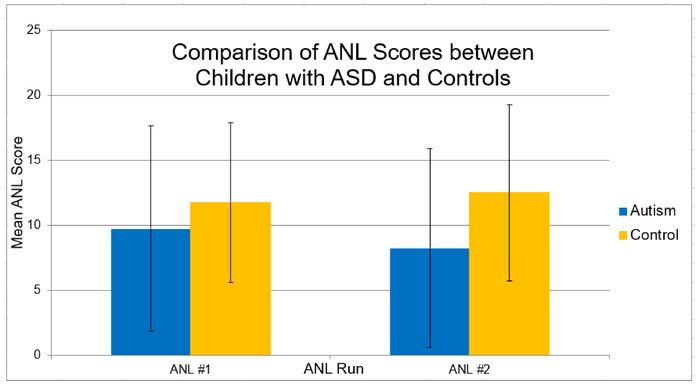

TABLE 1. Comparison of ANL #1 results for group, sex, and race

	Frequency, N	ANL Score #1, Mean (+/- SD)	t-test
Group			
Autism	20	9.8 (+/- 7.9)	t = -0.897
Control	20	11.8 (+/- 6.1)	df = 38, p = 0.38
Sex			
Male	31	10.3 (+/- 7.3)	t = 0.709
Female	9	12.2 (+/- 6.2)	df = 38, p = 0.48
Race			
Caucasian	35	10.4 (+/- 7.4)	t = 0.761
African American	5	13.0 (+/- 2.7)	df = 38, p = 0.45

TABLE 2. Comparison of ANL #2 results for group, sex, and race

	Frequency, N	ANL Score #2, Mean (+/- SD)	t-test
Group			
Autism	20	8.3 (+/- 7.7)	t = -1.858
Control	20	12.5 (+/- 6.8)	df = 38, p = 0.07
Sex			
Male	31	9.8 (+/- 7.8)	t = 0.841
Female	9	12.2 (+/- 6.2)	df = 38, p = 0.41
Race			
Caucasian	35	10.0 (+/- 7.9)	t = 0.838
African American	5	13.0 (+/- 2.7)	df = 38, p = 0.41

TABLE 3. Correlational analysis examining the relationship between parent rating and children's ANL scores

	ANL #1	ANL #2
	Correlation Value (r_s), *p-value*	Correlation Value (r_s), *p-value*
Parent Report and ANL Score (Children with Autism)	r_s = -0.09, p = 0.72	r_s = 0.08, p = 0.75
Parent Report and ANL Score (Typically Developing Children)	r_s = 0.24, p = 0.31	r_s = 0.13, p = 0.60
Parent Report and ANL Score (Entire Sample)	r_s = -0.06, p = 0.71	r_s = -0.11, p = 0.49

OUTCOMES

1) There is no significant difference on the ANL between children with ASD and typically developing children
2) There is no significant difference on the ANL between males and females
3) There is no significant difference on the ANL between Caucasian children and African American children
4) There is no significance between parent report of their child's sensitivity to loud sounds and their ANL score for parents of children with ASD and those of typically developing children

CONCLUSIONS

1) There are no significant differences on the ANL based on group, sex, or race
2) Parent report of their child's sensitivity to loudness was not indicative of children's performance on the ANL
3) Results are inconclusive as to whether the ANL is a useful assessment tool for children with ASD

FUTURE DIRECTIONS

1) Using the ANL on a different age group of children with ASD and those who might be more difficult-to-test might have different outcomes
2) Future research needs to be completed on children with ASD to see if there is a different test that may better quantify their loudness sensitivity

REFERENCES

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