

Abstract

It has been hypothesized that the loss of auditory nerve input due to cochlear synaptopathy (CS) could lead to difficulty in temporal coding and speech recognition in low speech-to-noise ratio situations in humans (Furman, Kujawa & Liberman, 2013). Musicians consist of an interesting population to study in the context of CS due to their excessive loud sound exposure on a daily basis. The experimental group consisted of 20 students ($M_{AGE} = 22.7$, $SD = 3$, range =18-28) enrolled in a music degree. The control group comprised 22 non-music students ($MAGE = 21.9$, $SD = 2.5$, range =18-27). An experimental version of the Hearing-in-Noise Test (HINT) allowed for manipulation of interaural level and time differences between speech and noise (ILD and ITD conditions, respectively), in addition to the usual noise-front and noise-side (90° azimuth, including both ITD and ILD cues) conditions. The musician group showed higher estimated lifetime exposure than the control group. Differences between groups for any of the noise conditions were small and of uncertain sign. The association between the HINT scores and estimated lifetime noise exposure was also small and of uncertain sign. It is possible that the young musicians included in our study did not have sufficient noise exposure to result in CS, or that the effects of CS in this population do not result in deficits in the processing of interaural localization cues that result in speech in noise deficits.

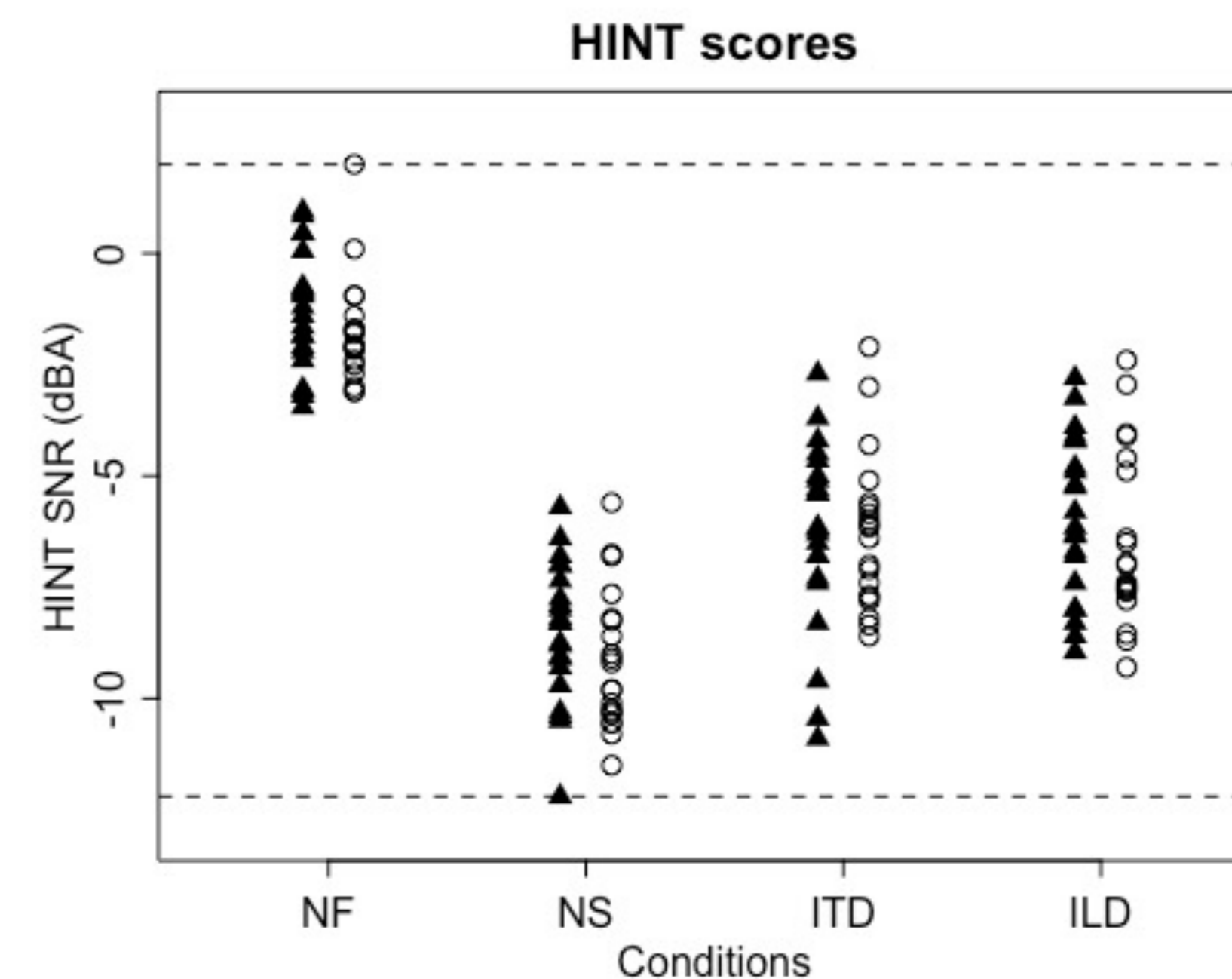
Objective

The objective of the study was to compare the performance of an at-risk group of student musicians with a control group of individuals with limited noise exposure on a speech-in-noise test and a gap-in-noise test.

Methods and Materials

- The participants' lifetime loud sound exposure was estimated using the Noise Exposure Structured Interview (NESI; Guest et al., 2018)
- Processing of speech in background noise was investigated using an experimental version of the Hearing-in-Noise Test (HINT; Nilsson, Soli and Sullivan, 1994)
- Temporal resolution measured through the Random Gap-in-Noise test (RGDT; Keith, 2000)

Results



Standardized HINT SNRs across groups and conditions. Filled triangles illustrate the HINT scores for the control group. Circles indicate scores of the musician group. Four conditions: Noise front, noise side, interaural time difference cues only, interaural level differences cues only.

- Experimental group showed higher estimated lifetime noise exposure than control group
- All participants benefitted from the separation of speech from noise
- Group differences for each HINT condition were very small and estimated sign difference (i.e. positive or negative) was uncertain
- Slope coefficients of the regression analyses of lifetime noise exposure scores and HINT-SNR for each condition were small and of uncertain sign
- Similar results obtained for the Random Gap-in-Noise Test for both groups

Conclusion

It is possible that (1) the young musicians included in our study did not have sufficient noise exposure to result in CS, (2) that the effects of CS in this population do not result in deficits in the processing of interaural localization cues that result in speech in noise deficits and / or (3) that the experimental version of the HINT used in the current research is not sensitive to CS.

References

- Furman, A. C., Kujawa, S. G., & Liberman, M. C. (2013). Noise-induced cochlear neuropathy is selective for fibers with low spontaneous rates. *Journal of neurophysiology*, 110(3), 577-586.
- Guest, H., Dewey, R. S., Plack, C. J., Couth, S., Prendergast, G., Bakay, W., & Hall, D. A. (2018). The noise exposure structured interview (NESI): An instrument for the comprehensive estimation of lifetime noise exposure. *Trends in hearing*, 22.
- Keith, R.W. (2000). Random Gap Detection Test. Auditec of St Louis Ltd. www.auditec.com
- Nilsson, M., Soli, S. D., & Sullivan, J. A. (1994). Development of the Hearing in Noise Test for the measurement of speech reception thresholds in quiet and in noise. *The Journal of the Acoustical Society of America*, 95(2), 1085-1099.