Music-listening Level Preferences in Musicians and Non-Musicians

Ozgenur Cetinbag[1], Samuel Couth[1] , Christopher J. Plack[1,2], Karolina Kluk[1]

[1] Manchester Centre for Audiology and Deafness, School of Health Sciences, University of Manchester, UK
[2] Department of Psychology, Lancaster University, UK

Background

- Previous studies have indicated that the vestibular system contributes to hearing (Todd & Cody, 2000; Todd et al., 2014), and the connection between these systems could be influenced by musicianship i.e. musical experience (Trainor et al., 2009).
- Musicians differ from non-musicians on both behavioural and electrophysiological measures (e.g. auditory evoked potentials), which may reflect superior auditory and vestibular function in musicians (Schneider et al., 2002).
- Musicians may prefer to listen to loud music to activate the limbic system (the reward centres of the brain) via activation of the vestibular system (Todd & Lee, 2015). Additionally, increased vestibular function helps musicians to better attend to musical rhythm, therefore they prefer to listen to music louder so that they can follow the rhythm via activation of the vestibular system (Trainor et al., 2009).

Aim

- This study aims to investigate the differences in preferred music-listening levels between musicians and non-musicians, and whether the vestibular function contributes to these differences.

Methods

Participants

Inclusion Criteria:

Musicians: Having at least six years of musical experience

Non-musicians: No experience of formal musical training and not actively playing an instrument

Exclusion criteria:

For both groups: Ear malformations and disorders, history of neurological or systemic disease, Any vestibular disorders, ototoxic / vestibulotoxic drug use, hearing loss.

Study design: This study consist of two parts: (1) online questionnaires and tests and (2) laboratory-based tests. For the online part of the study, 92 musicians and 96 non musicians (46F/45M/1 non-specified) with self-reported normal hearing completed online questionnaires. Subsequently, 28 musicians and 41 non-musicians completed online music-listening test (MLP).

For the second part of the study, 76 musicians and 74 non-musicians (87F/63M) were assessed using a lab-based MLP test and the cervical vestibular evoked myogenic potentials test (c-VEMPs).

All participants in both groups were aged between 19 and 45 (mean+sd=25.2±5.8) years. Musicians had an average of 15.1 ± 6.3 years of musical experience (ranging from 0 to 37 years).

Data Collection Procedure

1) Online Questionnaires and Tests:
- A series of online questionnaires
- Online Music-Listening Level Preference Test (onlineMLP)

- **Online Questionnaires:** The online questionnaires consisted of seven questionnaires referring to general health conditions, musicianship, audiological and balance evaluations. The questionnaires were created using REDCap platform.
- **OnlineMLP**: For this test, 6 music pieces each of a different genre (e.g., rock, metal, jazz, etc.) were chosen. Participants adjusted the level of each of the six pieces of music to their preferred by moving the position of the on-screen slider only.
- Participants who completed the online questionnaires and test were invited to participate in the second section of the study (lab-based MLP and c-VEMPs).

2) Lab-based Tests:
- Music Listening Level Preference Test (Lab-based)
- Cervical Vestibular Myogenic Potentials (c-VEMPs) Test

- **Lab-based MLP:** Music-listening preference (MLP) test allows participants to adjust volume levels manually via audiometer. The same 6 pieces of music with onlineMLP test, were presented through headphones from the CD player. The music pieces was adjusted to centre at an octave frequency of 500 Hz.
- **c-VEMPs:** The c-VEMPs amplitudes were recorded at 95 dB nHL at a 500 Hz frequency range. Two active electrodes were placed at the 1/3 upper part of the right and left SCM muscles, while the negative electrode was on the sternoclavicular junction, and the ground electrode was placed at the forehead.

Statistics

- All data analyses were conducted using Rstudio (Version 1.3.1093). Linear regression analyses used musicianship as a predictor variable on the outcome variable (onlineMLP) for all tests.
- A pre-registration for the study is published on the Open Science Framework website (https://osf.io/4vuxs).

Results

1) Online Music-listening test (onlineMLP)

➢ The regression equation was non-significant [F (5, 63) = 1.448, R^2 = 0.103, ***p* =0.915**]. This suggests that musicianship was not a significant predictor of online MLP .

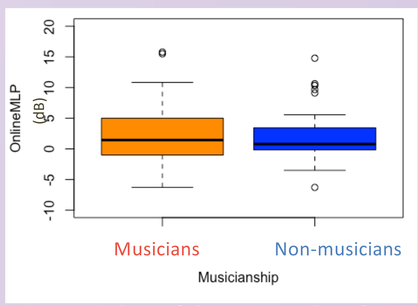

Fig. 1.Boxplots of the mean values for online music-listening levels in dB in both groups

➢ Figure 1 indicates that musicians (mean±sd= 1.98±7.16 dB) had slightly higher music-listening levels in dB than non-musicians (mean±sd=1.52±7.07 dB).

2) Music-listening test (Lab-based)

➢ The regression equation was significant [F (3, 149) = 14.38, R^2 = 0.209, ***p* <0.001**]. This suggests that musicianship was a significant predictor of MLP.

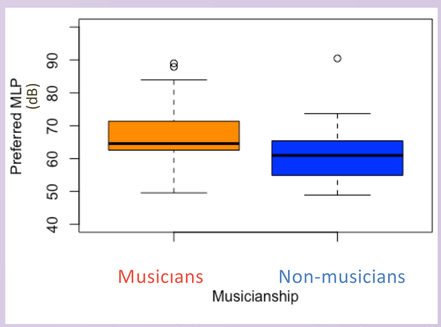

Fig. 2. Boxplots of the mean values for preferred music-listening levels in dB in both groups

➢ Figure 2 shows that musicians (mean±sd= 67.7±7.67 dB) had higher music-listening levels in dB than non-musicians (mean±sd=60.69±7.01 dB).

3) Cervical Vestibular Evoked Myogenic Potentials (c-VEMPs) Test

Coefficients				
	β value	Std. Error	*t*-value	*p* value
(Intercept)	162.1378	20.9709	7.732	<0.001
Musicianship	-36.7575	9.0386	-4.067	<0.001
Sex	5.9042	9.1248	0.647	0.519
Age	-0.1083	0.7949	-0.136	0.892

Table 2. Beta, t and p values and standard errors are presented for P1-N1 amplitude and covariates

➢ Table 2 indicates that the regression equation was significant [F (3, 149) = 6.57, R^2 = 0.099, ***p* <0.001**]. This suggests that musicianship was a significant predictor of c-VEMPs P1-N1 amplitude.

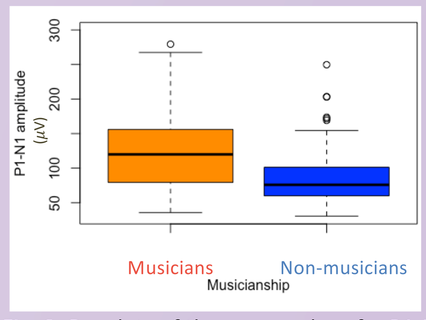

Fig. 3. Boxplots of the mean values for P1-N1 amplitudes in μV in both groups

➢ Figure 3 revealed that the P1-N1 amplitude was significantly higher in musicians (mean±sd= 126.0±60.6 μV) compared to non-musicians (mean±sd= 87.8±43.7 μV).

Conclusions

- The results of the laboratory-based music-listening test suggest that musicians prefer to listen to music at higher levels compared with non-musicians.
- Our findings also showed that musicians have greater vestibular function than non-musicians, assessed by c-VEMPs.
- Further, we aim to assess whether the relationship exists between music-listening level preferences and c-VEMPs amplitudes.
- We also intend to measure loudness perception via a loudness matching test to observe the potential effect of vestibular function on loudness perception.

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Acknowledgments

This research was funded by the MRC and supported by the NIHR Manchester Biomedical Research Centre, Ozgenur Cetinbag is funded by Scholarship from the Republic of Türkiye Ministry of National Education.

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