

Artículo original

Pop musicians and noise induced hearing loss

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Resumen

OBJETIVO

Investigar la prevalencia de la pérdida auditiva inducida por ruido entre músicos de rock y su percepción de la relación entre la música y el placer y el poder.

PARTICIPANTES Y MÉTODOS

A 27 músicos no profesionales del sexo masculino se les hicieron estudios de audiograma y logaudiometría. También respondieron la escala de cinco puntos tipo Likert en aspectos relacionados con la percepción de la música, el placer y el poder.

RESULTADOS

Todos los participantes tuvieron una curva audiométrica tonal pura dentro de los límites normales, aunque estaban expuestos a una presión de sonido media de 119.37 dB. El número promedio de ensayos/conciertos al mes fue de 15.50 ± 17.92 y algunos participantes (44.5%) tenían un desempeño activo en relación con la música rock de 4 a 10 años. Las respuestas a la escala de cinco puntos tipo Likert revelaron una fuerte tendencia de los participantes a considerar a la música como actividad placentera, así como una actividad relacionada con un sentimiento íntimo de poder.

CONCLUSIONES

Los resultados parecen indicar una posible relación entre estas percepciones y algún tipo de efecto protector. A este respecto, se necesitan estudios adicionales que utilicen métodos adecuados que incluyan los usados en los campos de la psicoacústica y las neurociencias.

Abstract

OBJECTIVE

To investigate the prevalence of noise induced hearing loss among rock musicians and their perception towards the relation of music to pleasure and power.

METHODS

Twenty-seven male non-professional musicians had audiograms taken as well as logo-audiometry. They also answered to a 5-point Likert type questionnaire on aspects related to perception of music, pleasure and power.

RESULTS

All subjects had a pure tonal audiometric curve within normal limits although being exposed to a mean sound pressure of 119.37 dB. The average number of monthly rehearsals/concerts was 15.50 ± 17.92 and some participants (44.5%) had an active involvement with rock music between 4 and 10 years. Answers to a 5-point Likert type questionnaire revealed a strong tendency of participants to consider music a pleasant activity, as well as an activity related to an intimate feeling of power.

CONCLUSION

The results seem indicate some possible association between these perceptions and some sort of protective effect. In this regard, additional studies are encouraged using adequate methodologies including those used in the fields of psychoacoustic and neurosciences.

Palabras clave:

pérdida auditiva inducida por ruido, música, percepción del volumen, percepción.

Key words:

noise induced hearing loss, music, loudness perception, perception.

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Introduction

Since the early 1950-decade rock music has arisen as an important gender of popular music and has remained until today a preference among young people. With the increasing technological sophistication of music instruments and audio equipments a high sound pressure of rock music concerts seems to be a necessary component of the performing act, from the point of view of the musicians as well as of the attendants. In this context, the development of noise induced hearing loss (NIHL) could be an expected outcome of the exposure to both audience and musicians. Some audiologic investigations have so far been performed to establish the possible damaging effect of pop music, in its many presentations, on the individual musician or in passive participants such as employees of discotheques.¹⁻⁶ The overall result of such studies shows surprisingly low figures in relation to the present scientific concepts and even popular believes on this regard. Axelsson and Lindgren² reported condensed table of studies analyzing a total of 160 pop musicians in whom sensorineural loss was found in only 5%. Rock band musicians can show a similar average hearing loss, affecting the high-frequency hearing at and above 8 kHz.⁷ Another study, conducted at the Rotterdam Conservatory, surprisingly revealed no difference on the occurrence of specific hearing loss in students of music as compared to a control group of students of the medical school working at a local hospital.⁸ The classic follow-up study by Axelsson et al.³ concluded that it was surprising that not less than 78% of 40 pop/rock musicians had a well-preserved hearing in spite of 26 years of exposure to loud musical sound levels. In brief, other studies show similar and unexpected results for a low incidence of noise induced hearing loss among pop/rock musicians.^{5,6,9,10} On the other hand, noise induced hearing loss shows a considerable prevalence among individuals exposed to industrial and other environmental noise.¹¹⁻¹⁴

Some reasons have been proposed to explain this intriguing resistance to high sound levels in professional or amateur active musicians. The most damaging sounds are the high frequency components that occur in industrial noise. In contrary, the dominant frequencies in pop music are low, raging from 250 to 500 Hz.¹⁵ The pauses between musical numbers could be another good explanation for such positive results if compared to the continuous industrial noise. In addition, harmful impulsive sounds are rare in pop/rock music.

At present, there is still not a good explanation for the resistance to loud sound levels in the musicians. Other fields should be explored to better understand these findings. It is believed that the attitude of musicians to their status and performance may play a positive and protective role. It is also suggested that desirable sounds (pleasant), such as musical sounds, are less damaging than the non-desirable (industrial noise). There-

fore, the relation of enjoyment (pleasure) of music and music performance could be an additional reason for the intriguing picture. Although it is quite difficult to diagnose and quantify pleasure by clinical methods, a preliminary qualitative investigation on the relation between music and pleasure can bring some light to this issue. In this connection, the purpose of the present study was to identify hearing loss in a group of rock musicians and investigate their attitude towards the relations between music, performance and pleasure.

Material and methods

The subjects were 27 male non-professional musicians, members of rock-bands with an average age of 21.81 ± 3.45 years. They had audiograms taken with an audiometer DICTON, model 744/021. The audiograms were taken in a closed cabin in an audiologic clinic by a phono-audiologist. The preparation of subjects, the acoustic environment and calibration followed the specification of international regulations (OSHA, ISSO and ANSI). Logo-audiometry was also taken in the same session. The level of 20 dB was taken as standard for normal audiometry and the logo-audiometry results were classified in below 80%, between 80 and 88% and above 88%. The ambient sound pressure level of exposure was measured during rehearsals with a calibrated Intelbra ETD 142B portable dosimeter (A-weighted). Data on the frequency of rehearsals and concerts were collected as well as that on the number of hours of exposure. All musicians answered basic information concerning their age, musical exposure period per week in hours, general and hearing health, the kind of instrument they played and the number of rehearsals/concerts per month. A structured closed questionnaire with a simplified 5-points Likert type scale was used to collect preliminary information on the perceptions of the musicians in respect to the relations between music and pleasure and, in addition, to the relation of power and pleasure (Annex 1). The questionnaire was prepared taking into consideration the need to eliminate ambiguous statements, negative statements or statements which might seem unduly leading. Statistical analysis of the results of the questionnaire was carried out using the Chi-square ($\alpha = 0.005$). Clearance for the study was obtained from the Council of Ethics in Research at the Sacred Heart University and a signed informed consent was obtained from the musicians.

Results

Less than half of the participants (44.5%) had an active involvement with rock music from the past 4 to 10 years (figure 1). The mean weekly exposure time was 7.07 ± 6.52 h (figure 2).

The number of monthly rehearsals/concerts was quite variable, average 15.50 ± 17.92 each month. All musicians reported that they were aware of the fact that high sound levels could

Annex 1. Questionnaire

You will find below a few topics that we would like to read attentively and give your answer according to the criteria. Note that there is no “wrong” or “correct” answers. We do need your most accurate personal answer on each topic. We want your opinion on each item and it does not matter to us the opinion of other people on your opinion. State your personal feeling. Do not answer taking into consideration what other people would think on your answer. Please, do not leave blank questions.

IMPORTANT: if you prefer, you do not have to identify yourself

The possibilities are:

- 1 = Strongly disagree
- 2 = Moderately disagree
- 3 = Neither
- 4 = Moderately agree
- 5 = Strongly agree

Indicate how much you agree or disagree with different statements and ideas by marking with an X in the desired box.

	1	2	3	4	5
Pleasure is an agreeable feeling that results from the achieved goal. Pleasure is joy. Pleasure is an agreeable, positive sensation.					
Listen to loud music can cause hearing damage.					
I prefer to listen to rock music than to classic music.					
I prefer to listen and to play pop music, those more rapid and vigorous than those more quiet, with a light and moderate tempo.					
It is a pleasant sensation to listen to loud music.					
I like Summer time.					
I really dislike the cold of winter.					
I do prefer Summer time than Winter time.					
Listen to music with low volume is not pleasant.					
A light touch can be very pleasurable to me.					
If some one makes a massage on my feet I would feel great pleasure.					
A massage in my back or my neck can be very pleasant.					
Warm applauses at the end a musical presentation cause a strong pleasure sensation.					
I am definitely happier to make a solo part than to play accompanying part.					
I feel more appealing to play when there are lots of people in the audience.					
After a concert, even tired, I am very pleased to give autographs and to be greeted by people.					
I can not use all my energy while playing to small audiences. It seems that I miss motivation.					
Playing is a pleasant activity to me.					
I prefer performances than rehearsals.					
During a concert I have a sensation that I dominate the audience. In fact, I am the one on the stage, not them. I am the one that dominate the technique of playing my instrument or singing and they don't.					
It is highly pleasant to induce the audience to sing together some piece of music. This is a sing that I am mastering them.					
When I have to play in a restaurant or party I become irritate, annoyed because people do not pay attention to my music.					
Playing in the rock band is more pleasant than my routine professional activity (or my student duties at school).					

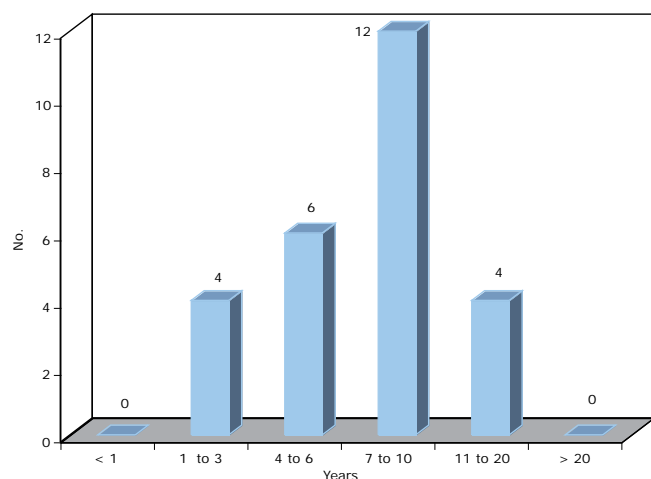


Figure 1. Period of involvement with rock music.

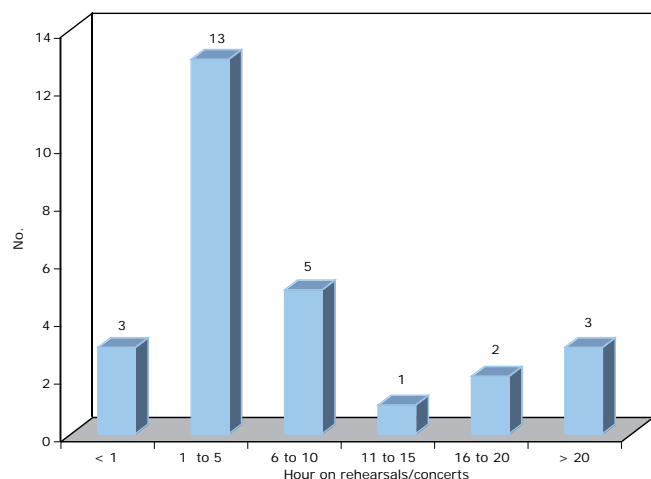


Figure 2. Mean weekly exposure time.

lead to hearing damage but only 22.3% referred to use some sort of hearing protection. The predominant instruments were: electronic guitar (10), vocalists (7), percussion instruments (7), bass guitar (6), guitar (3) and keyboard (1). The pure tone thresholds for the musicians are presented in figure 3. The median hearing thresholds at all test frequencies on both ears were within normal limits, that is, ≤ 20 dB. In the same way log-audiometry was within normality, that is, above 80% at levels of 50 dB. The measurement of the sound level made during the band rehearsals revealed an average sound level of 119.37 ± 8.66 dB.

The evaluation of the perception of pleasure related to music was statistically significant (χ^2 test, $p < 2.1 \times 10^{-28}$ $\alpha = 0.005$) comparing the answers of the pertinent items of the questionnaire to an even distribution of the various alternatives. The same applies for the perception of power and music (χ^2 test, $p < 2.95 \times 10^{-24}$ $\alpha = 0.005$) in the same circumstances.

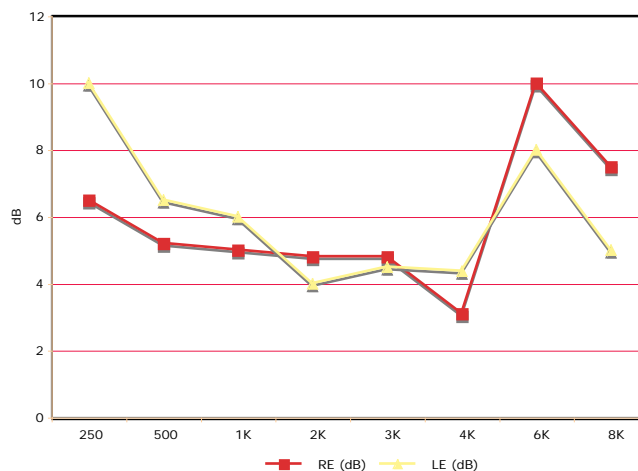


Figure 3. Mean pure tone threshold curves for the studied musicians.

Discussion

Many musicians express their concern about the high sound levels to which they are exposed, although usually they do not complain of any persistent disability after a performance.¹⁶ Indeed, most of the available literature that studied hearing loss in musicians reported that the hearing sensitivity in the pop/rock musicians was surprisingly well-preserved taking into consideration the high sound pressures they are exposed to for a considerable period, both during their lives and during rehearsals and concerts. As mentioned in the introduction, this becomes clearer when compared to the results of prevalence studies done among industry workers and other noisy working conditions. In this connection, the results of the present study are similar to those in the literature, showing normal hearing in a group of rock musicians exposed to environmental sound conditions far beyond acceptable levels. It is relevant to remember that what noise induced hearing loss is concerned, the 6 kHz level that can be seen in figure 3 is variable and of limited importance.¹⁷ Many reasons can be given to explain this intriguing result. A part from the physiological protective systems,¹⁸ the exposure for only a limited period with resting intervals together with the acoustic characteristics of rock music may contribute to such a limited prevalence of noise induced hearing loss among rock musicians. In the latter case, rock music is characterized by high energy in the low frequencies within a limited dynamic range while impulsive sounds are not common, what is less damaging when compared to the damaging environmental and industrial noise with high frequencies and impulsive sounds. Although musical sound also contains some "noise" component at the upper end of the audible range, it is important to note that noise and musical sound are quite different in terms of the arrangement of the harmonics partials. Noise can be defined as complex a-periodic sound waves, that is, sound

waves with irregular vibrations and indefinite pitch, which is not the case of the musical sound. Therefore, some extra causes should be explored to explain these results. Among them the fact that music and music performance can be perceived as a pleasant activity has been mentioned in the literature.³ This supposition has some connection with the findings of Wilson and Herbstein¹⁹ that report that high music intensity has been related to enjoyment and motivation to work in aerobic classes. If music sound leads to this perception, it may well be that a psychoacoustic definition of noise can be of some assistance: an acoustic signal that can affect negatively the physiological or psychological well-being of an individual.²⁰ Taking into account these different approaches between music sound and noise and considering the difficulties to quantify pleasure and enjoyment, the present study intended to go further in to this direction and tried to investigate the same group of musicians in regards to their perception between music and pleasure, and music and power. Although the group was very selected and some bias can be considered, the results revealed a strong tendency of the participants to consider music as a pleasant activity, as well as an activity related to an intimate feeling of power, taking into consideration that power has a marked connection to pleasure, in a broad sense. The results of both showed strong statistical significance. Among the statements could be depicted one stating that “Playing is a pleasant activity to me” had a 100% answer between “strongly agree” and “agree”. Another interesting fact is that the statement “Playing in the rock band is more pleasant than my routine professional activity (or my student duties at school)” was answered massively (87.42%) in the “strongly agree” and “agree” side while only 10.48% answered “undecided” or “disagree”.

Conclusion

Although the present study did not aim to go deeper into the psychoacoustic aspects of noise induced hearing loss and, therefore, can not establish a clear relation between pleasure with music and protective effect against noise induced hearing loss, it seems that the results indicate that some relation is possible between the musicians’ perceptions towards music and some sort of protective effect. In this regard, additional studies should be encouraged using adequate methodologies including those used in psychoacoustic and neurosciences.

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