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Research Article

Tinnitus Perception in Two Different Ethnic Groups

Amitkumar Tayade [1*]

[1] Communication Sciences and Disorders, Pennsylvania Western University at Edinboro, 215 Scotland Road, Room 237, Edinboro, PA 16444, USA.

***Corresponding Author:** Amitkumar Tayade, Communication Sciences and Disorders, Pennsylvania Western University at Edinboro, 215 Scotland Road, Room 237, Edinboro, PA 16444, USA.

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Abstract

Background and objective: The aim of this study was to determine if exposure to ten minutes of silence trigger the temporary tinnitus perception in normal hearing young adults, and to determine if there is a difference between Caucasian and individual from India (Asian) in tinnitus perception after ten minutes of silence, that is the association between tinnitus perception and ethnicity.

Method: In this study, data was collected from 58 normal hearing male (40 individuals from India-Asian and 18 Caucasians) adults between age 18-35 years. After ten minutes of silence exposure in the sound booth, participants were given a paper survey with questions to indicate the kind of temporary tinnitus perception that they may have experienced during or after silence period.

Results: Tinnitus was perceived by 46.55% of the participants during or after the period of 10 minutes of silence. Tinnitus perception was significantly greater in Caucasian (72%) compared to Asian (35%). This difference was statistically significant, showing the association between tinnitus perception and ethnicity. Tinnitus was perceived commonly in both ears (51.85%) and 'ringing' was the common type of tinnitus perception (40.74%) followed by 'Cricket' like sound (22.22%).

Conclusions: The study showed that tinnitus perception can occur in the non-clinical population in the silent environment. Caucasians are more likely to perceive tinnitus in/after the silence as compared to individuals from India (Asian). Ethnicity seems to be the variable worth considering in counselling related to tinnitus management.

Keywords: non-clinical population; sensory deprivation; hyper-excitation

Introduction

Tinnitus is the sound perception in the absence of an external auditory stimulus [1]. According to The American Tinnitus Association, an estimated 50 million people in the U.S. experience some form of tinnitus [2]. Approximately, 20 million people struggle with chronic tinnitus, and one million are completely disabled from it [2]. Chronic tinnitus can trigger other health problems such as anxiety, depression, distress, irritability poor concentration and sleep disturbance [3,4,5]. To date, there is no medical cure for tinnitus.

Tinnitus Retraining Therapy, a tinnitus management program given by Jesterboff [6] includes directive counseling, use of sound therapy and audiological testing. It is the most effective tinnitus management program practiced today. In this program, tinnitus patients are advised to avoid silence. Tinnitus perception may occur in non-clinical population in the silent environment [7,8,9,10]. Heller and Bergman [7] reported tinnitus perception in 94% of their normal hearing adult participants after exposing them to a brief duration of silence in the sound booth. However, the ethnicity was not the variable considered in their reported findings. Less sound input/silence/sensory deprivation in the peripheral auditory system may trigger a temporary hyper-excitation in higher auditory structures in the central auditory nervous system that is perceived as tinnitus [11]. Significant differences in tinnitus perception between Caucasian and African American normal hearing subjects were observed when they were exposed to a brief period of silence in sound booth [8], with tinnitus being more likely to be perceived by Caucasians (78%) than African Americans (38%). Knoble and Sanchez [9] observed 68.2% participants in their study experienced tinnitus perception in silence in auditory attention condition as compared to lower percentage of 45.5% in visual attention condition followed by 19.7% in Hanoi condition suggesting that the auditory attention plays an important role on the emergence of tinnitus.

The aim of this study is to determine if exposure to ten minutes of silence will trigger tinnitus perception in normal hearing Caucasian and Asian young adults and to determine if there is association between tinnitus perception and ethnicity

Materials and Methods

Population

The sample in this study was determined based on the recent study [8] that can be extended to the other ethnic groups. A total of 58 male participants between the age range of 18-35 years could participated within the timeframe

of this study. This participant pool consisted of 40 Participants from India (Asians) and 18 Caucasians.

Inclusion Criterion

All participants met the inclusion criterion: 1) Normal hearing thresholds of < or equal to 25 dB HL at octave frequencies from 250 Hz to 8000 Hz [12] and at 3000 and 6000 Hz; 2) No abnormalities or pathologies in the ear canal, including wax, as seen by looking in the ear with an Otoscope; 3) Normal middle ear function as evidenced by otoscopic examination and tympanometry (Static compliance between +100 daPa and -100 daPa, 0.33 cc > middle ear compliance < 1.75 cc). The inclusion criteria were determined based on the recent study [8].

Exclusion Criterion

Participants with history of hearing loss, chronic tinnitus, head trauma, middle ear pathology, ear surgery, neurological disease, and prolonged history of noise exposure or trauma were excluded from the study. (See Case History Questionnaire, Supplemental Document 1, which was used to document participants' case history related to hearing status, Neurological status, audiogram, otoscopy, tympanogram results, admission to study status and medical referral.) The exclusion criteria were determined based on the recent study [8].

Data Collection

The University of North Carolina at Greensboro (UNCG) Institutional Review Board (IRB) for the protection of human research participants approved this study. Each participant signed informed consent form before participating in the study. The participants recruited for this study were instructed to avoid exposure to loud sounds such as MP3 player music, vacuum cleaners, motorbikes, lawn mowers and so forth at least 12 hours before testing [13]. The data was collected in the sound-treated booth meeting American National Standards Institute (ANSI) standards in the Communication Sciences and Disorders department at University of North Carolina Greensboro.

Instrumentation and Calibration

The Grason-Stadler (GSI) 61 clinical audiometer and Eartone 3-A inserts were used to assess the auditory hearing sensitivity. GSI TympStar Middle Ear Analyzer was used to assess middle ear function. All the mentioned equipment were calibrated meeting ANSI standards before the data collection.

Procedure

Participants admitted to the study completed case history questionnaire. (See Case History Questionnaire, Supplement Document 1, Which describes case history related to hearing status, Neurological status). The auditory hearing thresholds were obtained for 250 Hz, 500 Hz, 1000 Hz, 2000 Hz, 3000 Hz, 4000 Hz, 6000 Hz, and 8000 Hz. Middle ear status was assessed using GSI TympStar Middle Ear Analyzer. All participants admitted to the study met the inclusion criterion on the questionnaire, pure tone audiometry, and middle ear assessment.

Each participant was seated upright in a comfortable chair inside the sound booth for ten minutes. The participants were instructed not to read, write, talk, or text during their stay in the sound booth. The participants were instructed to report any sound perception they may have experienced after ten minutes of silence in the sound booth. The word 'tinnitus' was intentionally avoided in the instruction to prevent any apprehension about the auditory perception, if any. After a ten-minute exposure to silence, the participants were asked to complete the sound perception questionnaire was provided (See Sound Perception Questionnaire, Supplement Document 2, which contains the questions to document any sound perception during or after the period of ten minutes of silence). This questionnaire was used for participants to self-report the location, duration, and types of tinnitus perceptions they perceived during and after the brief exposure to silence.

Data Analysis

Descriptive and inferential quantitative data was analyzed using the SPSS software (Version 20) spreadsheet. Case history form and tinnitus perception questionnaire provided the data on subject's demographic, type of tinnitus sounds, ethnicity, and ear differences. Pearson Chi Square statistics were performed to analyze the association between tinnitus and ethnicity. The level of statistical significance was set at $p < 0.05$. Percentage of tinnitus perception was determined for each ethnic group. Descriptive statistics for tinnitus perception, location and type was determined.

Results

The percentage of participants perceiving tinnitus, ethnicity, gender, and age data is shown in Table 1. Mean age of the participants was 26.96 years. All participants were male. The pool participants consisted of 40 participants from India (Asian) and 18 Caucasian participants. Out of 58 participants, approximately half (46.6%) of the participants perceived some type of tinnitus during or after the period of ten minutes of silence. Tinnitus perception was significantly greater in Caucasians (72%) compared to Asian (35%). Table 2. Shows that this difference was found to be statistically significant in the Pearson's chi-square test (χ^2 (1 d.f.) = 6.913, p = .009, N=58), showing the association between tinnitus perception and ethnicity.

		Ethnicity			Age Range	Mean Age	Gender
		Asian (Participants form India	Caucasian	Total	18-35	26.96	Male
Tinnitus	Yes	14 (35%)	13 (72%)	27 (46.55%)	19-33	26.03	27 (46.6%)
	No	26 (65%)	5 (28%)	31 (53.44%)	19-34	27.77	31 (53.4%)
Total	58	40	18	58	58		58

Table 1: Demographics table: Age, Gender, Tinnitus Perception, and Ethnicity Description Statistics

Chi-Square Tests					
	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	6.913[a]	1	.009		
Continuity Correction[b]	5.498	1	.019		
Likelihood Ratio	7.063	1	.008		
Fisher's Exact Test				.011	.009
Linear-by-Linear Association	6.793	1	.009		
N of Valid Cases	58				
a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 8.38.					
b. Computed only for a 2x2 table					

Table 2. Pearson's chi-square test: showing the association between tinnitus perception and ethnicity.

Descriptive statistics for tinnitus perception location and type is found in the Table 3. The percentage of tinnitus perception was observed to be greatest in both ears (51.85%) followed by 29.62% in the head, 11.11% in the right ear, and 7.40% in the left ear. The 'Ringing' type of tinnitus was perceived most (40.74%) among the participants followed by 'Cricket' (22.22%) and 'Buzzing' (11.11%).

		n	Percent
Tinnitus Location (N=27)	Right ear	3	11.11%
	Left ear	2	7.40
	Both ears	14	51.85%
	In the head	8	29.62%
Tinnitus Type (N=27)	Ringing	11	40.74%
	Cricket	6	22.22%
	Buzzing	3	11.11%
	Hissing	1	3.70%
	Pulsating	2	7.40%
	Clear Tone	2	7.40%
	Ocean Roar	1	3.70%
	Transformer	1	3.70%

N, total number of participants in each category, location, and type; n, total number of participants in each tinnitus location and type subcategories.

Table 3: Descriptive Statistics for Tinnitus Perception Questionnaire: Location and Type

Discussion

Tinnitus perception in the silence

The present study documents the emergence of tinnitus perception in the normal hearing individuals without any Ontological signs and symptoms if individuals are exposed to brief duration of silence/sensory deprivation. Tinnitus appears to be associated with less neural excitation in the periphery of ascending pathway and greater activity in more central auditory structures [11]. The findings from the current study support Eggermnot's theory and findings reported by [8]. Emergence of tinnitus after exposure to a period of silence was first reported in [7]. Their seminal study reported that 93.75 % of normal hearing adults experienced tinnitus perception after a period of silence. The emergence in this study was remarkably high and did not control for age, gender, or ethnicity. The overall percentage participant reporting tinnitus in the current study is significantly low compared to [7], may be attributed to self-reported normal hearing by the participants between age range 10-68 years in [7]. The Heller and Bergman study's [7] self-reported hearing thresholds might have not accounted for the actual hearing loss at higher frequencies due to old age which would contribute to the higher percentage of the tinnitus perception in their participants.

Knoble and Sanchez [9] reported tinnitus perception in 68.2% normal hearing participants in silence in auditory attention condition. Though, similar condition can be considered in current study, percent of tinnitus perception in current study is lower (46.6%) compared to [9]. The difference might be attributed to the different ethnic groups in current study which was not the variable considered in [9] study.

Tinnitus and Ethnicity

Since the work of Heller and Bergman [7], few studies have explored the emergence of temporary tinnitus perception in silence in normal hearing adults. Tucker et al. [8] observed an overall tinnitus perception in 64% of their study participants with normal hearing after a period of a silence. They reported a statistically significant ethnic difference in tinnitus perception between Caucasians (78%) and African American (38%) showing the association between ethnicity and tinnitus perception. The current study found a lower overall tinnitus perception percentage of 46.6% compared to 64% in [8], which may be attributed to the ethnicity of the participants.

The present study also found a difference in emergence of tinnitus perception due to ethnicity, with only 35% of Asian participants (participants from India) perceiving tinnitus when compared with 72% which suggests that Asian participants, like African American participants reported in [8], are less likely to perceive tinnitus during or after a period of silence. The percentage of Caucasian participants perceiving tinnitus in the present study (72%) is similar to that reported for Caucasian participants (78%) in the [8] study. Combined, these two studies suggest that Caucasians may be more likely to perceive tinnitus after an exposure to silence.

The higher percentage of the tinnitus perception in current study might have influenced by the auditory attention and expectation as argued in [9], for [7] and [8] studies. However, auditory attention might have influenced tinnitus perception in both ethnic groups in current study. To our knowledge there is no published study yet that focuses on the auditory attention and ethnicity in relation to tinnitus perception.

Tinnitus Sounds

Like in [8] study, 'ringing' was the most common type of tinnitus sound perceived participants. 'Cricket' sound was second most common type perceived in the current study whereas participants from [8] perceived 'buzz' as the second most common tinnitus sound type.

Conclusion

The study shows that silence can trigger the tinnitus perception in the non-clinical population. The occurrence of such silence induced tinnitus seems more likely be present in Caucasians than Asian ethnic group. Past studies along with this study indicate the association between the tinnitus and ethnicity. Such association could be considered while counseling related to tinnitus management. Further research is needed to identify the possible reasons and differences in tinnitus perception in other ethnic groups. Various factors such as noise exposure, genetic make-up, coping strategies for the stress, dietary habits and their effect on underlying neurophysiological differences contributing to the tinnitus perception in different ethnic groups needs exploration.

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