ORIGINAL PAPER

DOI: 10.5935/0946-5448.2020004

International Tinnitus Journal. 2021;25(1):13-17.

Perception of Tinnitus Handicap And Stress Across Age Groups in Normal Hearing

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ABSTRACT

Introduction: This research was conducted to investigate the severity of tinnitus, its impact on subject's daily, personal and emotional life, which varies widely across the age groups.

Methodology: Sample population of 60 unilateral tinnitus subjects with normal hearing between the age ranges of 15-55years were divided into four age groups. Tinnitus severity was measured using tinnitus severity index, impact of tinnitus on daily life was documented through tinnitus handicap inventory and the stress levels through perceived stress scale.

Results: A high frequency tinnitus was observed in age group of 56-65years, in contrast to noise like tinnitus in subjects aged 15-25years. The tinnitus was found to be most handicapping (38-56; moderate handicap) in Group 4(56-65years), the perceived stress levels were also falling in very high range (21 and over). Tinnitus severity index did not show any significant difference between the Group 1:15-25yrs, Group 2: 26-40yrs, Group 3:41-55yrs, and however group 4(56-65 yrs) did report with mild severity. The outcomes of present study demonstrated that elderly subjects certainly require modifications in the test protocols and referrals to address to their significant responses to tinnitus.

Keywords: Tinnitus, Tinnitus handicap inventory, perceived stress scale, tinnitus severity scale.

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Paper submitted on December 17, 2019; and Accepted on December 08, 2020

INTRODUCTION

A phantom sound not associated with any external stimulus is known as tinnitus, 33% of the elderly population are affected by tinnitus [1,2]. The prevalence of tinnitus has been estimated at 10 to 15% based on data obtained from epidemiologic studies conducted in different countries, [3]. Few studies report tinnitus is more prevalent among men, but is variable across various age groups [4]. The prevalence of chronic tinnitus increases with increasing age, peaking at 14.3% in people between 60 and 69 years of age. [5]. Researchers postulate that changes in the neuroplastic potential across the life span play a critical role in tinnitus generation. During senescence, the neuroplastic changes are predominant; hence, it influences not only the incidence of tinnitus but also distress related to tinnitus [6]. Tinnitus perception has also been strongly correlated with emotional impact. A large number of tinnitus individuals can cope with it, only 1 in 5 are reported to have emotional symptoms, [7], 0.5% of them are so severely impaired that it hampers their day to day functioning [8]. A recent study reported that "tinnitus can lead to significant distress, depression, anxiety and a decrease in quality of life" [9]. Tinnitus becomes more severe with stress, & the frequency of its occurrence increases in the elderly, [10]. However, many researchers have proposed that annoyance perceived due to tinnitus is possibly associated with a person's psychological state rather than hearing thresholds, It is complicated to understand why only a few tinnitus patients report it to be disabling and handicapping. Furthermore, the distress and severity of tinnitus vary widely across age groups contributing to poor understanding of factors related to tinnitus. It is very important to deduce the severity of tinnitus across age groups for health care implications, as well. Primarily an accurate estimate of the severity of tinnitus is required for appropriate resource allocation by governing authorities for the treatment of such disorders. Secondly, it helps us in making accurate clinical decisions regarding the tinnitus population, [11,12]. For these reasons, there is a requirement for further investigation of the impact of tinnitus among different age groups, as the studies conducted till now are very less in number, and none of them completely explain the severity, handicap, or stress variation among different age groups. Understanding these parameters would help us facilitate treatment and lead to better patient morbidity. Hence, the objectives of the present study were, to examine the variations in pitch and loudness of tinnitus among different age groups, further to evaluate the association between the severity of tinnitus and different age groups on the tinnitus severity Index, tinnitus distress on the perceived stress scale and impact on daily life through tinnitus handicap inventory.

METHODS

A total of 60 subjects having unilateral tinnitus (either in the right or left ear), who visited the tertiary care hospital were enrolled in the study. Participants reporting with any history of health diseases, psychiatric illness, and systemic disorder, or any tinnitus-related pathologies were excluded from the study. The participants were divided into four groups (15 in each group) based on their age range, Group 1: age range-15-25, Group 2: age range-26-40, Group 3: age range-41-55, Group 4: age range-56-65. All the subjects were administered with a history questionnaire and routine audiometric evaluation.

Pure tone audiometry: All the participants underwent pure tone audiometry on Madsen Orbiter 922 clinical audiometer using TDH-39 headphones. Pure tone thresholds were recorded at 250Hz, 500Hz, 1KHz, 2KHz, 4kHz, and 8KHz. Pure tone average was taken for frequencies 500Hz,1KHz, 2KHz, and 4KHz, pure tone average below 25dBHL was considered as normal hearing.

Demographics

A detailed case history evaluation was carried out, followed by measurement of tinnitus frequency and loudness. The contralateral ear to the tinnitus was used for conducting the tinnitus matching. For tinnitus matching pure tone was presented at 1KHz and 10dB above the patient's threshold in that ear. The pitch was changed till the closest match to the pitch of their tinnitus was obtained. After the frequency match, the stimulus was presented (pure tone or noise) 10 dBHL below the hearing threshold of the subject. The intensity was then increased in 2dB steps until the subject indicated that a perfect match was attained. All the subjects were assessed using a systematic interview and observation protocol for assessment of tinnitus-related distress, handicap, and severity. Effects of tinnitus on hearing, lifestyle, general health, and emotional disturbances like despair or frustration were recorded through Questionnaires: Tinnitus severity index (TSI), Tinnitus handicap inventory (THI), Perceived Stress Scale (PSS). An adapted Hindi version of THI was administered to all the patients, following the administration of the tinnitus handicap questionnaire, total scores were calculated, [13-15]. The responses of subjects were scored based on three options; yes, no and sometimes [16,17]. The questions with the response 'yes' were given a score of 4, whereas two were given for 'some time,' and '0' was given to 'no' response. The tinnitus handicap was then graded as mild 18, moderate (38-56) and severe (58-76) according to tinnitus handicap inventory. The stress level was rated as low (8-11), average (12-15), high (16-20) and very high (21 & over) based on scores obtained on PSS. Tinnitus severity was rated based on 12 questions, and rating of 0- to 5 was given, scores of 1-12(very mild), 13-24 (mild),25-36(moderate),37-48 (severe), 49-60 (catastrophic).

Statistical analysis: SPSS version 21 windows software was used for analysis. The descriptive statistics were used to obtain mean, the standard deviation for continuous variables and frequency and percentages for the discontinuous variables. The intergroup results were compared using MANOVA, and post hoc analysis was carried out. An Independent t-test was used to examine the statistical significance ($P<0.05$).

RESULTS

The age ranges taken for study and mean age of subjects and other demographic variables have been displayed in Table 1. Subjects of Group1 (15-25years) showed significant differences from Group 4 (56-65years) in terms of tinnitus frequency as well as loudness. Group 4 subjects perceived the pitch of tinnitus as tonal (93.3% subjects); however, the majority (86.6%) of group 1 reported tinnitus, as noisy. Subjects in group 4 had tinnitus lasting for more than 12 months.

The mean and standard deviation values among the three groups are shown in Table 2. In applying the ANOVA test, significant differences were observed among all the four groups on tinnitus handicap inventory, perceived stress scale as well as on tinnitus severity index.

The multiple comparisons were made for the tinnitus frequency among the four age groups. The significant difference was only observed between group 1 and group 4 (P=0.025), as shown in Table 3, indicating that subjects in the age range 15-25 had a different frequency of tinnitus in comparison to the subjects in the age range of 55-60yrs.

Post Hoc test results of tinnitus handicap scores showed significant differences between Group 1 and Group 2 (P=0.021), Group 1 and Group 3 (P=0.001), Group 1, and Group 4 (P=0.00) & Group 2 and Group 4 (P=0.047). Most of the subjects with the moderate handicap score on tinnitus handicap inventory fell in the Group 4 (56-65years age), however a large number of mild scoring subjects were found in the other three groups, i.e., Group 1, 2 and 3. It means that the tinnitus handicap increases as the age of the patient increases (Table 4).

Perceived stress scale was used for comparison of distress among four groups, likewise to THI scores, and the scores were again significantly different between the younger group (Group 1, 15-25years) and the other three groups. The significant p values were observed between Group 1 and Group 2 (P= 0.014), Group 1 and Group 3 (P=0.009), Group 1 and Group 4 (P=0.006), respectively. The scores of Group 4 were falling in the very high distress range; however, the Group 1 scores mainly settled in low distress range. Moreover, the comparison of stress scores of Groups 2,3 and 4 did not show any significant difference (Table 5). Lastly, the severity of tinnitus between different age groups was compared using the Tinnitus Severity Index. The significant difference was

Table 1: Demographic variables.

		Group 1(N=15)	Group 2 (N=15)	Group3(N=15)	Group 4(N=15)
Age range (years)		15-25	26- 40	41-55	56- 65
Mean age(S.D.)		20.56(9.73)	38.57(10.61)	41.25(8.40)	63.02(10.11)
Sex	Male	9(60%)	10(66.7%)	12(80%)	6(40%)
	Female	6(40%)	5(33.3%)	3(20%)	9(60%)
Tinnitus duration months	<12	10(66.7%)	11(73.3%)	11(73.3%)	1(6.67%)
	>12	5(33.4%)	4(26.7%)	4(26.7%)	14(93.3%)
Tinnitus localisation	Right	5(33.3%)	4(26.7%)	3(20%)	3(20%)
	Left	10(66.7%)	11(73.3%)	12(80%)	12(80%)
Tinnitus type	Tonal	2(13.3%)	11(73.3%)	10(66.7%)	14(93.3%)
	Noise	13(86.6%)	4(26.7%)	4(26.7%)	1(6.67%)

Table 2: Comparison of various tinnitus parameters among all the four groups.

Domain	Group 1		Group 2		Group3		Group4		f	Significance
	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D		
Pitch of tinnitus	4672.14	4055.6	6394.2	4438	7065.2	3348.74	8608.3	2657.2	1.91	0.142
Intensity	55.71	11.7	54.5	13	52.5	22.17	74.17	12.4	2.02	0.08
THI	20.14	9.38	32.29	14	36.27	6.81	41.33	14.56	6.58	**0.001**
PSS	11.01	4.08	20.41	11.59	20.17	6.74	21.34	5.39	3.32	**0.028**
TSI	12.03	0.57	15.13	1.72	14.75	1.44	16.113	1.16	13.62	**0.001**

p-value<0.01=highly significant;*p-value<0.05= significant; p-value>0.05=not significant (NS), THI-tinnitus handicap inventory, PSS –perceived stress scale, TSI – tinnitus severity index

Table 3: Multiple comparison of Tinnitus frequency among groups.

Parameter	Comparison	Mean difference	Std. Error	P
Tinnitus Frequency	Group1 Vs Group 2	-1722.057	1753.255	.331
Tinnitus Frequency	Group 1 Vs Group 3	-2393.079	1584.727	.138
Tinnitus Frequency	Group 1 Vs Group 4	-3936.190*	1692.025	***.025**
Tinnitus Frequency	Group 2 Vs Group 3	-671.022	1403.177	.635
Tinnitus Frequency	Group 2 Vs Group 4	-2214.133	1523.317	.153
Tinnitus Frequency	Group 3 Vs Group 4	-1543.111	1325.877	.251

Table 4: Multiple comparisons of tinnitus handicap inventory among four groups.

Parameter	Comparison	Mean difference	Std. Error	p
THI*	Group1 Vs Group 2	-12.157*	5.089	**.021**
THI	Group 1 Vs Group 3	-16.135*	4.600	**.001**
THI	Group 1 Vs Group 4	-21.190*	4.911	**.000**
THI	Group 2 Vs Group 3	-3.978	4.073	.334
THI	Group 2 Vs Group 4	-9.033*	4.421	**.047**
THI	Group 3 Vs Group 4	-5.056	3.848	.196

**p-value<0.01=highly significant; *p-value<0.05= significant; p-value>0.05=not significant (NS), THI* – tinnitus handicap scale

Table 5: Multiple comparisons of Perceived stress scale between the four groups.

Parameter	Comparison	Mean diff	Std. Error	P
PSS*	Group1 Vs Group 2	-9.400*	3.681	.014
PSS	Group 1 Vs Group 3	-9.167*	3.327	.009
PSS	Group 1 Vs Group 4	-10.333*	3.553	.006
PSS	Group 2 Vs Group 3	0.233	2.946	.937
PSS	Group 2 Vs Group 4	-.933	3.199	.772
PSS	Group 3 Vs Group 4	-1.167	2.784	.677

**p-value<0.01=highly significant; *p-value<0.05= significant; p-value>0.05=not significant (NS), PSS* – perceived stress scale

Table 6: Multiple comparisons on Tinnitus severity index among the four groups

Parameter	Comparison	Mean diff	Std. Error	P
TSI*	Group1 Vs Group 2	-3.100*	.670	**.000**
TSI	Group 1 Vs Group 3	-2.722*	.605	**.000**
TSI	Group 1 Vs Group 4	-4.083*	.646	**.000**
TSI	Group 2 Vs Group 3	.378	.536	.485
TSI	Group 2 Vs Group 4	-.983	.582	.098
TSI	Group 3 Vs Group 4	-1.361*	.507	**.010**

**p-value<0.01=highly significant; *p-value<0.05= significant; p-value>0.05=not significant (NS), TSI* – tinnitus severity index

chiefly observed between Group 1 and the other three groups. Group 1 perceived tinnitus severity in very mild range, in comparison to the other three groups essentially falling in mild category. In conducting Post hoc analysis significant, differences were observed between Group 1 and Group 2 (P=0.000), Group 1 and Group 3 (P=0.00), Group 1 and Group 4 (P=0.00), Group 3 and Group 4 (P=0.010).

DISCUSSION

Tinnitus prevalence has been many times associated with senescence as well as concomitant hearing loss, [11.] However, our study emphasizes "age" solely as a critical contributing factor towards the distress, handicap, and severity of tinnitus. Recent research revealed that subjects above 40 years of age were essentially affected with severe tinnitus, moreover the severity of stress was far greater in these patients,[16]. Literature also stated that subjects above 40 years of age are less able to deal with tinnitus and thus have higher depression scores 3. The present study also supports the research stating that "patient's reaction to tinnitus is a complex interaction between acoustic phantom symptoms, somatic attention, and depressive symptoms", 17. Most of the subjects in group 4 (56-65 years) had a higher score of distress, and severity, and tinnitus handicap, thus increasing their risk for depression & anxiety. This could be attributed to the steady worsening of the tinnitus over a passage of time and the tendency of subjects to tolerate the symptoms of non- life-threatening conditions like tinnitus,16. Similar results have also been reported by Swiahb JA et al. that tinnitus largely affects individuals 40-60yrs of age, followed by above 60 years of age, & then less than 40 years of age. They supported their finding of the largest tinnitus prevalence in 40-60years of subjects, as 67.7% of these subjects present with sensorineural hearing loss [16].

The location of tinnitus, the type of tinnitus, was similar to what has been reported by previous researchers, [17,18]. The left ear is more susceptible to injury and prone to tinnitus due to the anatomical variations in the efferent system of the left and right side [19,20]. The younger age group reported with more noise-like tinnitus & adult and older subjects with more tonal tinnitus. Previous researchers have also reported 2718Hz to be the average value of tinnitus in adults [21]. Some researchers reported that the tinnitus frequency concentrated beyond 2000hz and largely above 4000Hz [22,23]. Tinnitus handicap inventory measures the impact of tinnitus on daily life [24]; however tinnitus severity index studies the emotional and psychological impact of tinnitus on the subject's life and perceived stress scale measures the perception of stress. In the present study, subjects between 56-65years of age showed a significantly larger impact of tinnitus on daily life as well as the stress, emotional and psychological

wellbeing, & least impact of tinnitus noticed in the youngest group (15-25years). Another researcher in 2009 documented that men and senior citizens reported with loud and annoying tinnitus, [25]. Axelson and Ringdehl further revealed that greater the tinnitus severity, chances of sleep disturbances increase among the tinnitus subjects, [26]. It can thus be hypothesized that subjects in the age range of 56-65yrs were more emotionally aroused and made greater attempts to cope with their tinnitus and therefore reported with a greater number of problems and emotional focused coping behaviour [27]. Thus, the results of the present study provide significant information to audiologists while intervening geriatric subjects suffering from tinnitus because these subjects certainly require modifications in the diagnostic as well as tailor-made intervention strategies [28]

CONCLUSION

This study showed that increasing age not only led to changes in tinnitus frequency, but also increased severity and handicap. In the younger population tinnitus was less stressful and had a limited effect on their daily life. The gradual increase in tinnitus severity could be attributed to the deterioration of brain mechanics due to aging.

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