Study of Nature and Gender differences of a group of Persons Suffering from Tinnitus

[1]Sujoy Kumar Makar, [2]Rajeev Jalvi & [3]Ashok Kumar Sinha,

Abstract

Tinnitus is widespread amongst clients attending hearing clinics and has been associated with a range of physical and emotional disorders (Hallam R.S., Jakes, S.C., and Hinchcliffe, R.. 1988).Hence to understand the distress caused by tinnitus and its relationship with the nature of tinnitus so as to suggest the appropriate treatment, there is the need to study the audiological and psychological characteristics of a group of tinnitus sufferers on the basis of verbal description of tinnitus and audiological measurements of tinnitus to understand nature and gender differences. Fifty adults in the age range of 18 to 60 years with subjective tinnitus with bilateral normal hearing or pure SNHL ranging from mild to moderately severe were selected. An audiological profile of each subject was prepared on the basis of brief case history of subject, otoscopic examination, pure tone audiometry, impedance audiometry, effective masking level, was conducted for all cases. A psychological profile was developed by using Tinnitus Reaction Questionnaire (TRQ) and Nature of Tinnitus Questionnaire (NTQ). These questionnaires were translated and adopted in Hindi and Bengali language after appropriate standardization procedure. 60% reported that they do not have any idea regarding probable cause of their tinnitus. Not even a single subject in the present study reported the cause of their tinnitus as consumption of alcohol. 74% subjects of this study reported that there is no fluctuation in the pitch of their tinnitus. However, 68% reported loudness of tinnitus is fluctuating. There was a significant correlation between the impact of tinnitus and disturbance of sleep caused by it with increase in depression and anger (.483). However, no significant co-relation was seen between distressed caused by tinnitus and duration of tinnitus (-.034). The multiple nature/sounds of tinnitus had far more devastating effects or serious impact on 'tinnitus sufferers' than the single sound/nature. Gender differences were also found among tinnitus sufferers while assessing the audiological and psychological measures of tinnitus. Female subjects also reported a higher level of emotional reaction with a mean of 35.9 to their tinnitus as compared to males with a mean of 31.7. Tinnitus has resulted in multifold effects/impacts on tinnitus sufferers where it has made them feel unhappy, tense, irritable, depressed, annoyed, distressed and frustrated. It has interfered with their enjoyment, their relaxation, their sleep, and forced them to avoid quite and social situations. These studies would further help in the overall management of the patient suffering from tinnitus.

Key words: Psychological profile, Tinnitus reaction, Questionnaire, Nature of Tinnitus Questionnaire, Tinnitus sufferers

Tinnitus is widespread amongst clients attending hearing clinics and has been associated with a range of physical and emotional disorders (Hallam R.S., Jakes, S.C., and Hinchcliffe, R. 1988). Clients exhibit a wide range of reactions both physical and psychological to the presence of tinnitus. The psychological distress that are associated with tinnitus include worries, anxiety, depression, irritability, disturbance in social life, stress, tiredness, feeling of illness, disturbance in concentration, personality disorder and sleep disturbance. Besides physical and psychological distress, emotional difficulties are also an important feature of subjects living with tinnitus. Researchers have observed that people with self-reported severe tinnitus experience excessive stress which affects their emotional balance and ability to cope (Kirsch et al., 1989).

The emotional distress associated with tinnitus was suggested to be the consequences of

[1]*Clinical Supervisor, Ali Yavar Jung National Institute for the Hearing Handicapped, email:kumarmakar@yahoo.com.* [2]*Reader and Head, Department of Audiology, Ali Yavar Jung National Institute for the Hearing Handicapped, Bandra, Mumbai.* [3]*Reader and Assistant Director, Ali Yavar Jung National Institute for the Hearing Handicapped, Bandra, Mumbai.*

the sound being perceived as threat or due to lack of control of the tinnitus sounds or noises. Thus attention to the tinnitus sounds or noises is assumed to bring about distress either because it is associated with the attribution of some threatening state of affairs or because the act of attending tinnitus interferes with activities which are more in tune with the needs of the moments. Though habituation to tinnitus noises is the normal response but this process may take weeks, months or some times years in some cases. Therefore, suffering and complaint are the exception and needs to be explained as a failure or habituation. (Hallam, Hanchcliffe, and Jakes, 1988)

Hence to understand the distress caused by tinnitus and its relationship with the nature of tinnitus so as to suggest the appropriate treatment, there is the need to study the audiological and psychological characteristics of a group of tinnitus sufferers on the basis of verbal description of tinnitus and audiological measurements of tinnitus to understand nature and gender differences.

Method

The present study proposed to develop a profile of the tinnitus sufferers by studying audiological and psychological characteristics of a group of tinnitus sufferers. This profile will enable to develop an appropriate management or remedial program for the tinnitus sufferers

Research design: - Survey type

Selection of subjects :- 50 adults with the age range between 18 years to 60 years were selected on the basis of following criteria:-

With Tinnitus in either of the ears or in both ears but without having any other associated problems like Vertigo, Headache etc. They should have subjective tinnitus, with bilateral normal hearing sensitivity or pure sensorineural hearing loss ranging from mild to moderately severe, with PTA from 10 dB HL to 70 dB HL. With normal ENT & Neurological examination.

Tool used for the study

(A) Audiological Profile:

An audiological profile of each subject will be prepared/ developed on the basis of following guidelines.

(1) Brief case history of subject including/highlighting age and gender of subject, educational qualification, details about tinnitus such as the age at onset of tinnitus, duration of tinnitus, nature of tinnitus as well as a verbal description of the tinnitus at present and any information regarding the way the tinnitus may have changed in nature since it was first noticed, any treatment taken for tinnitus, details about hearing status like normal hearing, hearing loss, if any, then type and degree of hearing loss, age of onset of hearing loss, whether the tinnitus is associated with hearing loss, impact of both i.e. hearing loss and tinnitus on daily living and details of treatment taken for both. This will help in ascertaining the eligibility of the subject as a sample for the study.

(2) Otoscopic Examination: - Visual examination of ear canal and tympanic membrane of the both the ears were carried out with a hand-held otoscope by lifting the pinna behind and upwards. So as to determine the status of ear canal and tympanic membrane.

(3) Pure Tone Audiometry (PTA) of each subject was carried out following the standard procedure (Hudghson & Weslacke Bracketing Technique) to determine the hearing threshold by using MAICO MA-52 well calibrated dual channel audiometer with TDH –39 supra-aural headphones with MX-41 cushion in a sound treated room. With noise levels within permissible limits according to ANSI (1991) standard for maximum permissible ambient noise level.

(4) Immittance Audiometry was carried out by using GSI-38 Immittance audiometer with 226 Hz probe tone for each subject to rule out middle ear pathology, if any.

(5) For **profiling frequency** (pitch) and intensity (loudness) of tinnitus, following stimuli were presented at all frequencies using bracketing procedure. This was done by using the same audiometer so as to check whether the patient's description of the tinnitus matched with that of the measurement of tinnitus.

PureTones (Continuous, Pulse and Warble).

Noise (Narrowband, White and Speech).

The patient was then instructed verbally to first match the pitch of the tinnitus with that of the pitch of the given tone (Pure Tone/noise). At different frequencies pure tone and noise were presented through the headphones to the ear opposite to the one where tinnitus was present (i.e. contralateral ear). The subject was then asked to match the loudness of the tinnitus at the selected tone or noise. Thus using the same procedures as used for pitch matching, different intensities were presented through the headphones, till the patient matched the loudness of his tinnitus with the given intensity.

(6) The effective masking level was determined for each subject, by presenting masking signal in

ascending order (5 dB steps) until the patient indicated that his/her tinnitus is undetectable. This was the level that has effectively masked his/her tinnitus when it was presented in ipsilateral ear.

Thus with the help of above mentioned tests and procedures a complete and a satisfactory audiological profile was developed for each tinnitus sufferer.

(B) Psychological Profile

An appropriate and satisfactory psycho-logical profile was developed by using following two questionnaires namely.

(1) Tinnitus Reaction Questionnaire (TRQ): This questionnaire was developed by Wilson, Henry, Bowen and Haralumbus 1991. This has provided the information about the impact of tinnitus on the each tinnitus sufferer in terms of distress, anxiety, depression and disturbance of personality like neuroticism, etc.

(2) Nature of Tinnitus Questionnaire: This is a modified version of "University of IOWA Questionnaire for tinnitus" developed by Stouffer J.L and Tyler Richard S. This questionnaire was used to find out the 'nature' of tinnitus of each subject. This has provided the information about the patient's description of his/her tinnitus in terms of pitch and loudness matching.

These questionnaires were translated and adopted in Hindi and Bengali language after appropriate standardization procedure. This translated questionnaires were field tested on 30 adults whose mother tongue was Hindi and Bengali respectively so as to avoid any ambiguity in the questionnaires. Each patient was seen by an otologist as well as neurologist to ensure that the nature of tinnitus cannot be corrected medically or surgically.

Procedure: Fifty adults in the age range of 18 to 60 years with a mean range of 48years 1 month who fulfilled the above criteria were selected. There were 28 males and 22 females with mean age of 48 years 5 months and 47 years 6 months respectively.

After a brief history to ascertain the eligibility of the patient as a subject of the study, they were subjected to the following test / evaluations.

Pure tone audiometry was carried out following the standard procedure to determine the hearing threshold.

To determine whether the tinnitus sounds more like a tone or more noise, one of these stimuli was presented for one minute followed by the other.

Pure Tones (Continuous, Pulse and Warble), Noise (Narrowband, BBN and Speech), and asked the patient to match the sounds most like your tinnitus.

Pitch and loudness matching of tinnitus was done following loudness balance procedure using same audiometer. To match the pitch, a pure tone/noise was presented contra laterally at a frequency well below the perceived tinnitus pitch, so that patients can easily tell the difference in pitch between the tone and the tinnitus. Tone was presented generally at 10-20 dB SL at frequencies where hearing was within normal limits and 5-10 dB SL (or less) where hearing thresholds was significantly elevated.1000 Hz is a good starting frequency. This frequency was described to the patient as a 'mid pitched tone' to provide a reference. Tones of different frequencies were then presented in octave intervals to gradually and identify the octave frequency that was closest to the perceived tinnitus pitch. Interoctave tones were then presented more closely to identify the exact tinnitus frequency. The pitch-matched tone was then compared with tones an octave higher and an octave lower, to ensure that the patient has not made the common mistake of '**octave confusion'**.

The tinnitus loudness match measured to the closet 5 dB step. Match stimuli were presented 5 dB below the threshold and increased the level in 5 dB steps until the patient reports a loudness match. The loudness matched was recorded in dB SL.

To find out the relation between 'traditional audiological pitch and loudness measures of tinnitus' and 'subjects' description of pitch and loudness of tinnitus', subject's were asked to describe the most prominent pitch of their tinnitus on 5 point scale, where 1- very low (250 Hz and below), 2-low (500 Hz) ,3- medium (1000 Hz-3000 Hz), 4-high (4000 Hz - 6000 Hz), and 5- very high (>6000 Hz). Similarly they were also asked to describe the most prominent loudness of their tinnitus on 5 point scale where 1-very faint (0 dB SL and below), 2-faint (5 dB SL), 3-medium (10 dB SL), 4- slightly loud (15 dB SL) and 5-very loud (>20 dB SL).

To measure effective masking level (EML) of tinnitus, the BBN /NBN /PT were presented to the ear with tinnitus, starting at the hearing threshold level. The level of the noise is raised in 5 dB steps until the patient cannot hear the tinnitus in the test ear. Once the tinnitus was completely masked in the test ear, the patient was asked if tinnitus can be heard in the contralateral ear. If tinnitus was not heard contralaterally, EML testing was completed and the level of the noise was unilateral EML. If the patient reports tinnitus in the contralateral ear,

then the noise was maintained at EML in the tinnitus ear, while noise in the contralateral ear was raised in 5 dB steps until the tinnitus was completely masked in that ear. At lower intensity level with BBN, tinnitus was masked completely then other stimuli.

Tinnitus Reaction Questionnaire (TRQ) and Nature of Tinnitus Questionnaire (NTQ) were administered to the patient as soon as the pure tone testing, pitch and loudness matching and effective masking level were completed. Clarifications were given whenever the patient had doubts about the questions.

On Tinnitus Reaction Questionnaire relative degree of distress for each patient was scored by adding the number marked for each item. The score obtained for each patient was then related to the patient's description of nature of tinnitus on Nature of Tinnitus Questionnaire.

However before preparing an Audiological and Psychological profile of each tinnitus sufferer, a written consent was taken from each subject.

The data was analyzed by using a standard statistical program called "**SPSS"** as well as by using percentile method, Pearson correlation, and parametric "t" test. The analyzed data was interpreted and discussed in the light of review of literature, research question and the objective of the present study.

		Percentage
a) **Personal tinnitus history**	Yes	No
Masked by environmental noise	74	26
Problems getting to sleep	72	28
Number of sounds-single	72	28
Number of sounds-multiple	28	72
b) **Personal perception of tinnitus**		Percentage
Pitch of tinnitus	Very Low (< = 250 Hz)	06
	Low (500Hz)	22
	Medium (1000 Hz to 3000 Hz)	30
	High (4000 Hz to 6000 Hz)	32
	Very High (> 6000 Hz)	10
Pitch of tinnitus fluctuating	Yes	26
	No	74
Loudness of tinnitus	Very faint (0 dB SL and below)	04
	Faint (5 dB SL)	26
	Medium (10 dB SL)	48
	Slightly Loud (15 dB SL)	14
	Very loud (20 dB SL and above)	08
		Percentage
Loudness of tinnitus fluctuating	Yes	32
	No	68
Location of tinnitus	Left	22
	Right	24
	Both ears	54
		Percentage
Qualities best describe your tinnitus	Whistling	28
	Ringing	18
	Hissing	32
	Buzzing	38
	Humming	06
	Other	14
	Combination of two or more	28
Tinnitus becomes worse	Being in noisy place	14
	Being in quiet place	16
	Changing head position	04
	Lack of sleep	18
	When you are excited	12
	Early in morning	18
	Nothing above makes it worse	22
	Others	24
		Percentage
c) **Probable causes of tinnitus**		Yes / No
Accident		04 / 96
Consuming Alcohol		- / -
Consuming drugs/medicines		04 / 96
Noise exposure		06 / 94
Others		26 / 74
No idea		60 / 40

Table 1: Showing the percentage of Personal tinnitus history, Personal perception of tinnitus & Probable cause of tinnitus

Results and Discussion

The majority of sample (60%) reported that they do not have any idea regarding probable cause of their tinnitus; however 6% reported their tinnitus due to noise exposure while 4% reported it due to accident and consuming drugs (medicines). Moller (1984) reported that the cause of most forms of subjective tinnitus is a matter of speculation where as Majumdar, Mason and Gibbin (1983) stated that whistle tinnitus may accompany almost any otological disorder, its site of origin and the method of its development and generation are unknown. Similarly Coles, R.R.A (1984b) reported that tinnitus is most commonly associated with disorder or damage or

degeneration in the internal ear, most common in the form of age related hearing loss (ARHL) or noise induced hearing loss (NIHL).

Not even a single subject in the present study reported the cause of their tinnitus as consumption of alcohol. Similar observations were reported by Spitzer (1981) where, alcohol may have little or no effect on tinnitus among many individuals, but may appear to make it 'worse' in some and 'better' in others.

74% subjects of this study reported that there was no fluctuation in the pitch of their tinnitus while 68% reported that there is no fluctuation in the loudness of their tinnitus. This was in contrast to findings of Stouffer and Tyler (1990), and Kemp and George (1992) who found that a number of patients reported daily fluctuations in quality and loudness of their tinnitus and that it was associated with higher perceived levels and annoyance. However, Ross Dineen, Janet Doyle and John Bench (1996) reported that majority of their study subjects has found their tinnitus as constant.

		Statistical test	c My tinnitus has interfered with my sleep
b.	My tinnitus has led me feel depressed	Pearson Correlation	.612(**) degree of correlation
		Sig. (2-tailed)	.000 significant at .01 level

Table 2: Showing correlations between tinnitus and depression and sleep disturbance caused by it. **All the correlation are significant at the 0.01 level (2-tailed).

From the above table it can be seen that there was a significant correlation between the impact of tinnitus and disturbance of sleep caused by it with increase in depression and anger. Thus tinnitus has made these subjects more depressed which have significantly increased their levels of anger. The possible root cause for this as estimated by this researcher may be "difficulty in getting to sleep" because of presence of their tinnitus.

Impact of Tinnitus reaction	Statistical test	Duration of Tinnitus
My tinnitus has made me feel distressed	Pearson Correlation	-0.034 degree of co-relation
	sig. (2 tailed)	.813 Not significant

Table 3: Showing relationship between degree of tinnitus and its durations:

To find out the relationship between relative degree of distress and duration of tinnitus, the data was further analyzed using Pearson's correlation and t test. The results are shown in table 3.

Item	Nature of Tinnitus	
	Single nature	Multiple nature
My tinnitus has made me unhappy	13.9%	42.9%
My tinnitus has made me tense	5.6%	42.9%
My tinnitus has made me feel irritable	8.3%	42.9%
My tinnitus has made me feel angry	8.3%	14.3%
My tinnitus has led me to cry	2.8%	7.1%
My tinnitus has led me to avoid quiet situation	2.8%	50.0%
My tinnitus has led me feel less interested in going out	11.1%	35.7%
My tinnitus has led me feel depressed	5.6%	35.7%
My tinnitus has led me feel annoyed	2.8%	28.6%
My tinnitus has led me feel confused	0%	7.1%
My tinnitus has "driven me crazy"	0%	7.1%
My tinnitus has interfered with my enjoyment of life	5.6%	50.0%
My tinnitus has made it hard for me to concentrate	11.1%	42.9%
My tinnitus has made it hard for me to relax	11.1%	50.0%
My tinnitus has made me feel distressed	2.8%	35.7%
My tinnitus has made me feel helpless	2.8%	21.4%
My tinnitus has made me feel frustrated with things	2.8%	28.6%
My tinnitus has interfered with my abilities to work	19.4%	35.7%
My tinnitus has led me to despair	8.3%	21.4%
My tinnitus has led me to avoid noisy situation	16.7%	35.7%
My tinnitus has led me to avoid social situation	25.0%	28.6%
My tinnitus has led me to feel hopeless about the future	0%	21.4%
My tinnitus has interfered with my sleep	11.1%	14.3%
My tinnitus has led me to think about suicide	0%	7.1%
My tinnitus has made me feel panicky	0%	21.4%
My tinnitus has made me feel tormented	8.3%	21.4%

Table 4: Showing Tinnitus Reaction Questionnaire Score for nature of tinnitus

However, no significant co-relation was seen between distressed caused by tinnitus and duration of tinnitus (-.034). This has indicated that the length of time for which tinnitus is present has not influenced the perceived ability of the subject to cope with it which suggests that habituation to the tinnitus has not occurred. This is in contrast to the observation reported by Tyler and Baker (1983) that the level of distress caused by the tinnitus should decrease over time. However, Hallam et al., (1984) argued that there are certain individuals in whom such habituation process does not occur. This lack of habituation has been found to be associated with the personality characteristics and the presence of tinnitus.

From the above table, it can be viewed that the multiple nature/sounds of tinnitus has far more devastating effects or serious impact on 'tinnitus sufferers' than the single sound/nature. Similar findings were reported by Ross Dineen, Janet Doyle and John Bench (1996) that subject with multiple tinnitus sounds (n=40) found their tinnitus more louder (Z= -1.845, P=0.03), more annoying (z = -2.206, P=0.01), more difficult to cope with (z= -2.308, P=0.01), and had a greater level of reaction to their tinnitus as compared to subjects who reported it like a single sound.

Audiological measures of tinnitus

The four frequencies PTA ranged from 10 dB HL to 70 dB HL with mean of 53.4 dB HL and standard deviation of 17.1 for right ear, and 12.8 dB HL to 57.5 dB HL with a mean 53.4 dB HL and standard deviation 16.6 for left ear respectively.

The tinnitus frequency matching has been found to range from 125 Hz to 8000 Hz for 5 subjects with pure tone and pulse tone, speech noise for 3 subjects, narrow band noise for 35 subjects, and wide band noise for 6 subjects.

The tinnitus intensity matching was found to range from 30 dB HL to 90 dB HL in both ears with mean of 63.1 dB HL and standard deviation of 14.7 in right ear and mean of 61.7 dB HL with standard deviation of 17.1 in left ear respectively.

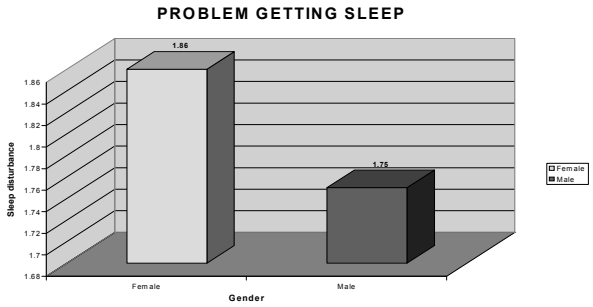
Total 49 subjects had measurable tinnitus while only one subject's tinnitus could not be measured because pitch and loudness was beyond audiometric limit and also she attempted to commit suicide because of her intolerable tinnitus.

The effective masking level were found to be ranged from 0 dB SL to 45 dB SL in both ears with mean of 8.5 dB SL and standard deviation of 12 in right ear and mean of 7.10 dB SL and standard deviation of 8.98 in left ear respectively.

The results are, a weak co-relation has been seen between traditional audiological measures like pitch matching, loudness matching and subject's description of pitch and loudness of tinnitus. Similar study was reported by Hallam et al., (1988); & Dineen et al., (1993), where traditional audiological measures of tinnitus, such as pitch and loudness matching were weakly related to self reported perceived pitch and loudness level of tinnitus.

Gender differences

Gender differences were also found among tinnitus sufferers while assessing the audiological and psychological measures of tinnitus.



Graph 1: Showing Gender Differences in Difficulties Getting to Sleep due to Tinnitus.

Independent Samples Test

	Levene's test for equality of varience			
	F	Sig	df	Sig. (2-tailed)
MALE	1.702	.199	42	.000 significant
FEMALE			41.652	.000 significant

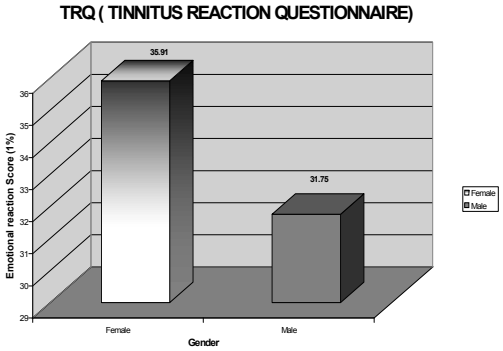
**All the correlation are significant at the 0.000 level (2-tailed).

Table 5: Showing Gender Differences in Difficulties Getting to Sleep due to Tinnitus

The female had more difficulty getting sleep compaired to males as indicated by the mean score (female 1.86, male 1.65) and t-test result (t-test significant 2- tailed at .000 level). Similar study was reported by Ross Dineen, Janet Doyle et al., (1996) where female subjects indicating more difficulties in getting to sleep because of tinnitus than male subjects.

Female subjects also reported a higher level of emotional reaction with a mean of 35.9 to their tinnitus as compared to males with a mean of 31.7. This had made female subjects more frustrated than their male counterparts. In contrast to this study, Hallberg and Erlandsson (1993) reported no gender differences in regard to psychological reactions to tinnitus, such as interference with

concentration, irritability or sleep disturbances. However Ross Dineen, Janet Doyle and John Bench (1996) reported female subjects with a higher level of emotional reaction to their tinnitus as compared to males.



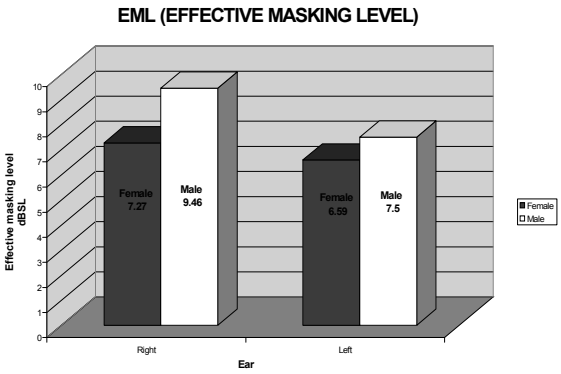
Graph 2: Showing Gender Differences in Impact of Tinnitus

Also female subjects perceived their tinnitus 'more louder' and thus 'more annoying' than their male counterparts with TRQ scores significantly higher for female subjects >35.9 than males 31.7.

The frequency to which tinnitus was matched was higher in female subjects with a mean of 3963.2 Hz and 3602 Hz for right and left ear respectively than their male counterparts with mean of 3047.6 Hz and 3228 Hz for right and left ear respectively. In contrast to this study, Ross Dineen, Janet Doyle and John Bench (1996) reported that frequency to which tinnitus was matched was higher in male subjects than female subjects with male mean of 5332 Hz and female mean of 3976 Hz respectively.

Tinnitus Intensity Matching (TIM) tended to be higher in female than male subjects with male mean for right ear and left ear as 61.88 dB HL, and 59.38 dB HL respectively with that of female mean for right ear and left ear as 64.05 dB HL and 63.41 dB HL respectively. All the correlation was significant at the 0.01 level (2-tailed). Similar findings were reported by Ross Dineen, Janet Doyle and John Bench (1996) where tinnitus intensity matching was higher in female than male subjects (male mean = 7.5 dB SL, female mean = 10.5 dB SL).

Effective masking level tended to be higher in male subjects than female subjects with male mean for right ear and left ear 9.46 dB SL and 7.50 dB SL respectively with that of female mean for right ear and left ear as 7.27 dB SL and 6.59 dB SL. In contrast to this study, Ross Dineen, Janet Doyle and John Bench (1996) reported no significant differences between female and male subjects with reference to effective masking level.



Graph 3: Showing Gender Differences in Effective Masking Level

Thus, this is an overview of audiological and psychological characteristics of a group of tinnitus sufferers.

Conclusions

Maximum subjects were able to forget about their tinnitus at times, as it was masked by environmental noises while 14% reported that it remained same even in noisy places.72% subjects perceived their tinnitus like whistling, ringing, buzzing and hissing. 74% subjects of this study reported no fluctuation in the pitch of their tinnitus while 68% reported no fluctuation in the loudness of their tinnitus. A significant co-relation has been seen between tinnitus and annoyance as well as distressed and sleeps disturbances caused by it. Tinnitus has resulted in multifold effects/impacts on tinnitus sufferers where it has made them feel unhappy, tense, irritable, depressed, annoyed, distressed and frustrated. It has interfered with their enjoyment, their relaxation, their sleep, and forced them to avoid quite and social situations. It has affected their concentration and reduced their interest in going out.

Longitudinal study will give more comprehensive result on an audiological and psychological profile of tinnitus sufferers. These studies would further help in the overall management of the patient suffering from tinnitus.

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