International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2019): 7.583

Morbidities in Tinnitus

MD Sharif Alam[1], C. S. Prasad[2]

[1]MS ENT, JPN Hospital, Gaya, India

[2]Deputy Superintendent, JPN Hospital Gaya, India

Abstract: ***Tinnitus is a very common complain and affects 7% of population and has been associated with a range of physical and emotional disorders (Hallam et al. in Br J Clin Psychol 27:213–222, 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 impact of tinnitus of a group of tinnitus sufferers. This study could be done on the basis of verbal description of tinnitus, Audiological measurement of tinnitus and psychological characteristics of tinnitus in terms of distress, anxiety, depression and disturbance of personality, to understand the morbidities in tinnitus. Fifty adults in the age range of 18–60 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, frequency (pitch) and intensity (loudness) of tinnitus. A psychometric profile was developed by using Tinnitus Reaction Questionnaire and Nature of Tinnitus Questionnaire. These questionnaires were translated and adopted in Hindi language after appropriate standardization procedure. 60% reported that they do not have any idea regarding probable cause of their tinnitus. 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. 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. There was a significant correlation between the impact of tinnitus and disturbance of sleep caused by it with increase in depression and anger (0.483). However, no significant co-relation was seen between distressed caused by tinnitus and duration of tinnitus (−0.034). 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 quiet environmental and social situations. Its resistance to treatment. Lack of knowledge regarding pathophysiology. These findings should further help in the overall management of the patient suffering from tinnitus.***

Keywords: Psychological profile, Tinnitus reaction, Questionnaire, Nature of Tinnitus Questionnaire, Tinnitus morbidity

1. Introduction

Basically and broadly tinnitus is defined as the condition where there is a sensation of sound experienced by the tinnitus sufferer but there is no corresponding sound in the acoustic environment [17, 18]. Almost everyone has experienced a short, faint, ringing in the ears at some time or others may have noticed it after listening to loud music or after any loud sudden noise. All such noises are referred to as 'tinnitus' or 'head noises' [17, 18]. However, it goes unnoticed in most people in the presence of day-to-day environmental noises which may be louder than their tinnitus.

Tinnitus is classified into two categories, objective and subjective: objective tinnitus is sounds or noises that can be heard by others as well as by the sufferer with or without the need to use stethoscope or other forms of noise-amplifying instrumentation. Objective tinnitus has also been termed as "pseudo-tinnitus", "vibratory" or "extrinsic". It is either due to vascular phenomena or muscle changes such as spasm of the muscle of the middle ear or palate. They are present in less than 1% of patients who have tinnitus as a main complaint [14]. In subjective tinnitus, the neural signals corresponding to the tinnitus, which are present in the auditory cortex, may have been produced by a lesion in the cortex itself or at any further stage in the auditory pathway. Thus subjective tinnitus is one which arises within the cochlea or in the subsequent stages of the auditory system [17, 18]. According to Henry et al. [7] the problems caused by tinnitus indicate that the limbic system and the autonomic nervous system are activated by the tinnitus signal, and that is what causes the irritation felt by the tinnitus patients. There is disinhibition of DCN (Dorsal cochlear nuclei) also there is more excitation and less inhibition at subcortical level.

Statistically the exact cause of tinnitus is still not found, however, the cause of tinnitus is not limited only to the inner ear and auditory nerve, but presence of wax in external auditory canal or any middle ear disorder such as otitis media, otosclerosis, etc. can give rise to tinnitus. Quite often tinnitus is present in patients without any detectable abnormality in the external, middle or inner ear or in the auditory nerve.

National Centre for Health Statistics [16] reported presence of tinnitus in 32% of the USA population with 6% having severe degree of tinnitus, however no such statistics is available for Indian population. Dineen et al. [3] reported that female subjects indicated more difficulties in getting to sleep because of tinnitus than male subjects.

Tinnitus is widespread amongst clients attending hearing clinics [12] and has been associated with a range of physical and emotional disorders [5, 21]. 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

Licensed Under Creative Commons Attribution CC BY

of illness, disturbance in concentration, personality disorder and sleep disturbance. Besides physical and psychological distress, emotional difficulties are also an important feature of subjects with tinnitus. Several researchers have observed that people with self-reported severe tinnitus experience excessive stress which affects their emotional balance and ability to cope [8, 11].

Dineen et al. [2] reported that tinnitus sufferer's experiences stress from a number of sources not directly related to the tinnitus. Life stresses, such as career or domestic pressure and emotional states such as anxiety or depression, may affect the level of reaction to tinnitus and influence the choice of coping strategies that the individual applies to manage their experience of tinnitus.

Different treatment methods like medical treatment, surgical treatment, palliative treatment, use of tinnitus maskers and hearing aid if there is accompanying hearing loss, electrical stimulation, psychotherapy, relaxation therapy, etc. are used for tinnitus but with very little success.Cognitive and behavior therapy, Tinnitus retraining therapy now a days yoga, meditation (pranayama) and relaxation therapy have been in use to help the patient to cope up with the irritation and distressing aspect of tinnitus. Counselling is also important to say it is music of brain or it go along with you don't mind it.

The emotional distress associated with tinnitus was suggested to be the consequences of 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 mental focus on tinnitus interferes with activities which are more in tune with the needs of the moments. Though habituation to tinnitus noises is the normal response in many but not all cases this process may take weeks, months or some times years. Therefore, suffering and complaint are the exception and needs to be accepted as a failure of habituation [5].
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 impact of tinnitus on a group of tinnitus sufferers.

Need for the Study
Tinnitus prevalence around 7% and its rising alarm in pediatric population. It is more bothersome in older age group. The problem of tinnitus in India is also as alarming and as severe as in the Western countries; but there is dearth of studies in India related to tinnitus and its associated impact on the individuals.

This study will help the professionals to understand the cause and impact of tinnitus in a better manner which in turn will help them to treat the tinnitus or at least to reduce its impact in a more satisfactory manner.

2. Method

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

Selection of Subjects
50 adults with the age range between 18 and 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, with normal ENT & Neurological examination report.

Tool Used for Study
Brief case history of subject 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, 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.

Otoscopic Examination
Visual examination of ear canal and tympanic membrane of the both the ears was carried out with a hand-held otoscope.

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 well calibrated audiometer with supra-aural headphones with cushion in a sound treated room. With noise levels within permissible limits according to ANSI (1991) standard for maximum permissible ambient noise level.

Immittance Audiometry was carried out by using immittance audiometer with 226 Hz probe tone for each subject to rule out middle ear pathology, if any.

For profiling frequency (pitch) and intensity (loudness) of tinnitus, Pure Tones (Continuous, Pulse and Warble)/Noise (Narrowband, White and Speech) 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.

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) well below the perceived tinnitus pitch, so that patients can easily tell the difference in pitch between the tone and the tinnitus. The pitch-matched tone is then compared with tones an octave higher and an octave lower,

Licensed Under Creative Commons Attribution CC BY

to ensure that the patient has not made the common mistake of 'octave confusion'. 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. The loudness matched recorded in dBSL or dBHL.

Tinnitus Reaction Questionnaire (TRQ)
This questionnaire was developed by Wilson et al. [22]. 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.

Nature of Tinnitus Questionnaire
This is a modified version of "University of IOWA Questionnaire for tinnitus" developed by Stouffer and Tyler Richard. 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 language after appropriate standardization procedure. These translated questionnaires were field tested on 30 adults whose mother tongue was Hindi so as to avoid any ambiguity in the questionnaires.

Each patient was seen by an otologist as well as neurologist to ensure that the cause of the tinnitus cannot be corrected medically or surgically.

3. Procedure

Fifty adults in the age range of 18–60 years with a mean range of 48 years 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.

PureTone Audiometry (PTA) of each subject was carried out following the standard procedure to determine the hearing threshold.

Pitch and loudness matching of tinnitus was done following loudness balance procedure using same audiometer.

Tinnitus Reaction Questionnaire (TRQ) and Nature of Tinnitus Questionnaire (NTQ) were administered to the patient as soon as the pure tone testing was 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. The patient's description of nature of their tinnitus was categorized as follows: (a) Lateralization of tinnitus, (b) Duration of tinnitus, (c) Continuity of tinnitus, (d) Quality of tinnitus, (e) Pitch of tinnitus, (f) Loudness of tinnitus, (g) Other factors affecting tinnitus.

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.

4. Results and Discussion

The analyzed results are presented under four sections:
1) History of tinnitus sufferers.
2) Psychological and Audiological characteristics of tinnitus sufferers.
3) Gender differences, if any among tinnitus sufferers.
4) The impact of tinnitus on group of sufferers.

The history questionnaire yielded the information shown in Table 1. As the sample size was comprised of 50 subjects, the results were obtained in terms of percentage.

Table 1: Showing the percentage of personal tinnitus history, personal perception (pitch and loudness) of tinnitus & probable cause of tinnitus

	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)	6
	Low (500 Hz)	22
	Medium (1000–3000 Hz)	30
	High (4000–6000 Hz)	32
	Very high (>6000 Hz)	10
Pitch of tinnitus fluctuating	Yes	26
	No	74

Licensed Under Creative Commons Attribution CC BY

Loudness of tinnitus	Very faint (0 dBSL and below)	4
	Faint (5 dBSL)	26
	Medium (10 dBSL)	48
	Slightly loud (15 dBSL)	14
	Very loud (20 dBSL and above)	8
	Percentage	
Loudness of tinnitus fluctuating	Yes	32
	No	68
Location of tinnitus	Left	22
	Right	24
	Both ears	54
Qualities best describe your tinnitus	Whistling	28
	Ringing	18
	Hissing	32
	Buzzing	38
	Humming	6
	Other	14
	Combination of two or more	28
Tinnitus become worse	Being in noisy place	14
	Being in quiet place	16
	Changing head position	4
	Lack of sleep	18
	When you are excited	12
	Early in morning	18
	Nothing above makes it worse	22
	Others	24
(c) Probable causes of tinnitus	Yes	No
Accident	4	96
Consuming alcohol	–	–
Consuming drugs/medicines	4	96
Noise exposure	6	94
Others	26	74
No idea	60	40

Maximum subjects (74%) 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. Similar findings were reported by Slater and Terry [17, 18] that tinnitus become unnoticed in most people in the presence of day to day environmental noises.

72% subjects reported difficulty in getting sleep due to tinnitus. They perceived their tinnitus like whistling, ringing, buzzing, and hissing where as only 28% subjects perceived their tinnitus like multiple sounds. Similarly, Slater and Terry [17, 18] found that tinnitus is louder and more at nights as compared to day. In conclusion, we can say that tinnitus have severe impact on sleeping pattern of the majority of sufferers. That leads to further anxiety and depression.

32% subjects reporting their tinnitus as high pitched (4000–6000 Hz), 22% reporting it as low pitched (500 Hz) and 30% reporting it as medium pitched (1000–3000 Hz). These findings were similar like Meikle and Taylor-Walsh [15] study who found that 54% of the patients matched their tinnitus to tones above 4000 Hz (high frequency), 21% reported their tinnitus between 1000 and 3000 Hz (medium frequency) and 11% reported their tinnitus as below 1000 Hz (low frequency) (Fig. 1).

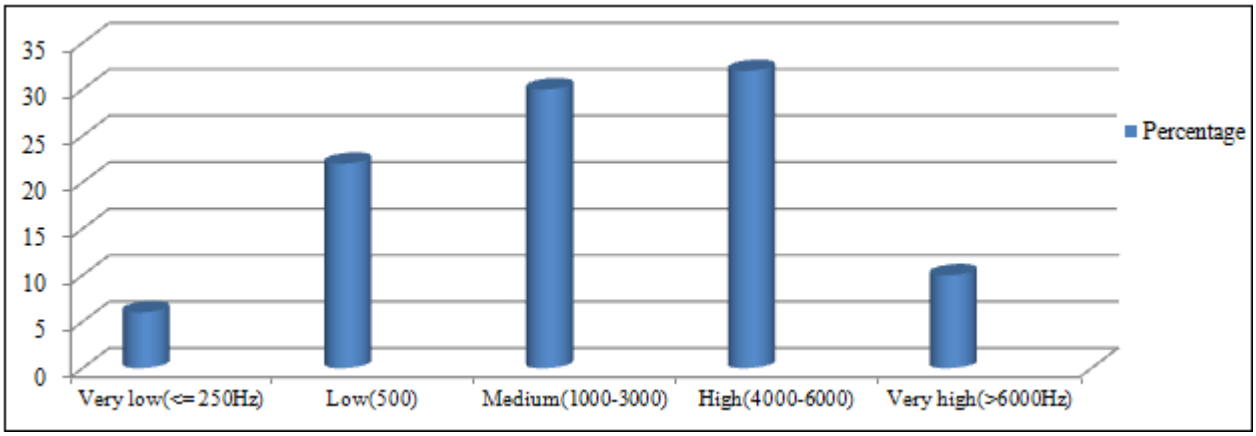

Figure 1: Showing pitch of tinnitus as described by tinnitus sufferers

Licensed Under Creative Commons Attribution CC BY

48% subjects has reported their tinnitus as mediumly loud (10 dBSL), 26% has reported it as faint (5 dBSL), 14% reported it as slightly loud (15 dBSL) where as only 8% has reported it as very loud (20 dBSL and above) (Fig.2). This was in contrast to findings of Meikle and Taylor-Walsh [15] where 51% of the patients matched the loudness of their tinnitus at 0–3 dBSL, 28% has reported the loudness of their tinnitus from 4–6 dBSL, 8% has reported it from 7–9 dBSL, and 11% has reported it above 10 dBSL.

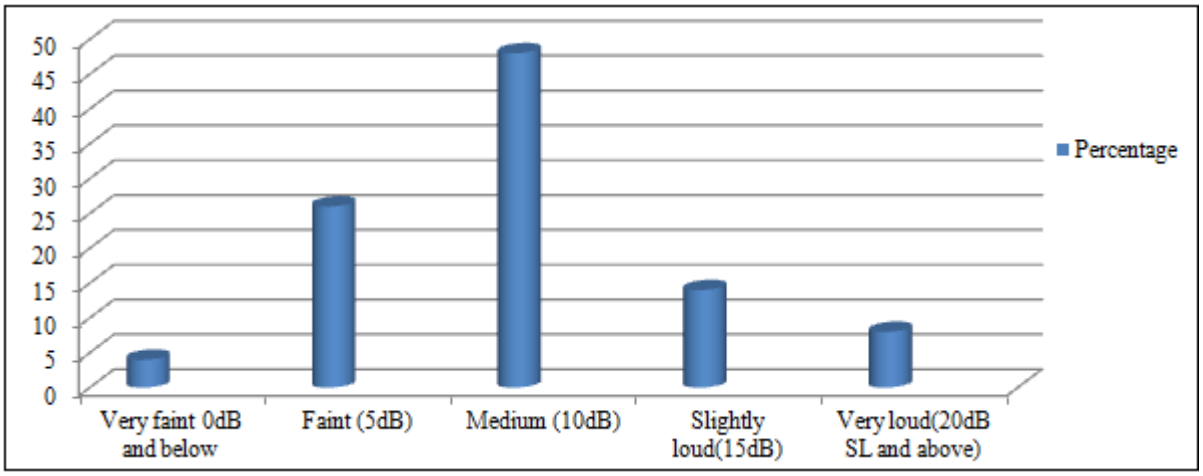

Figure 2

Showing loudness of tinnitus as described by tinnitus sufferers

This study has further found that 54% subjects reporting their tinnitus present in both ears, 24% reporting only in right ear while 22% reporting only in left ear (Table1).

With reference to the quality of their tinnitus, 38% subject reported it like buzzing, 32% reported it like hissing, 28% perceived it like whistling, 28% reported it as combination of two or more sounds, where as 6% of them reported it like humming (Fig. 3).

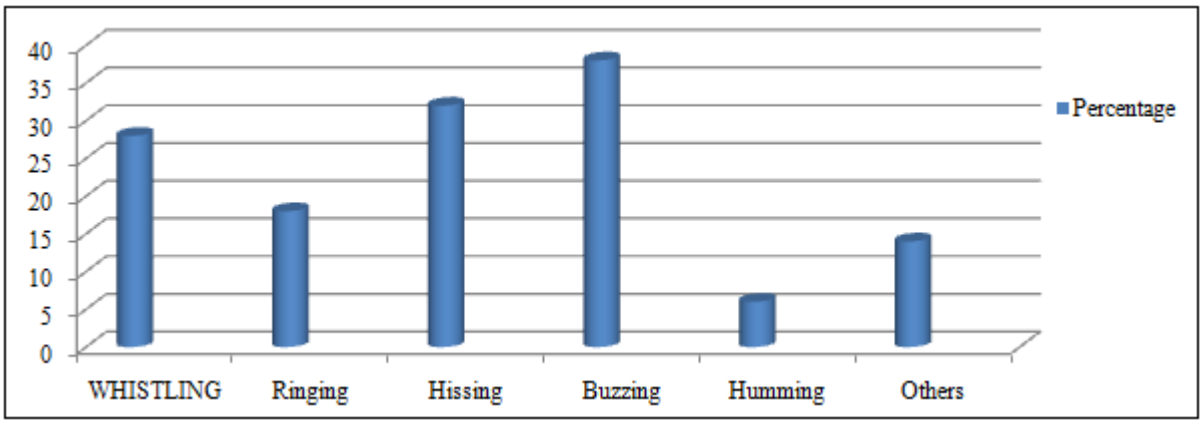

Figure 3

Showing qualities of tinnitus as described by tinnitus sufferers

18% subjects of the present study reported that they were commonly aware of their tinnitus at early morning, 16% reported the awareness of the same in quite places, 12% reported its awareness when they are excited, while 4% reported its presence as more significant due to changes in their head position (Fig. 4). Hallam et al. [4] reported that 70% of her patients who were suffering from tinnitus found that noise became more noticeable when they were excited, while 27% reported no change, which was contrast to findings of present study.

Licensed Under Creative Commons Attribution CC BY

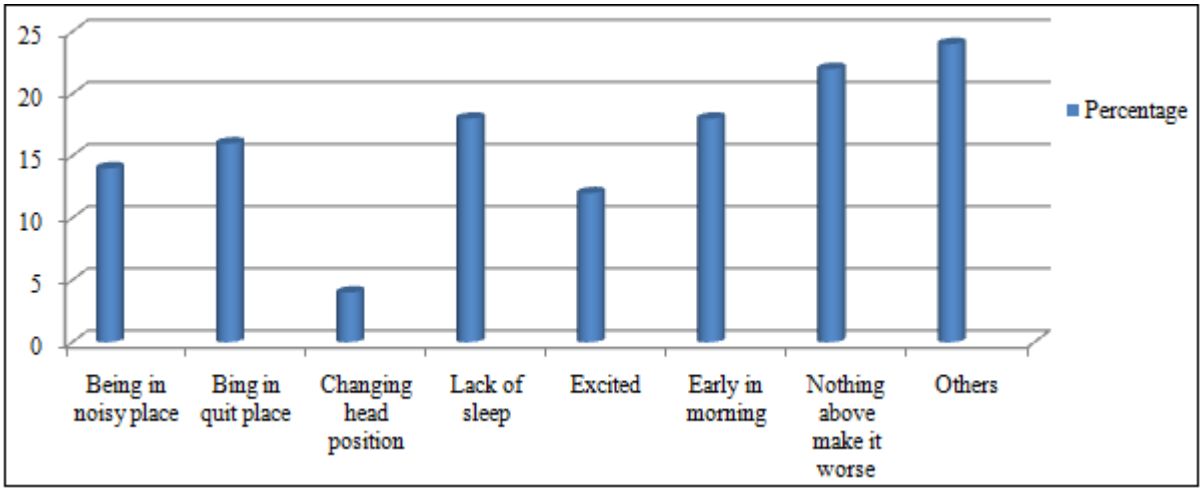

Figure 4

Showing different environmental situations where tinnitus become worse

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). Where Coles [1] 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) (Fig. 5).

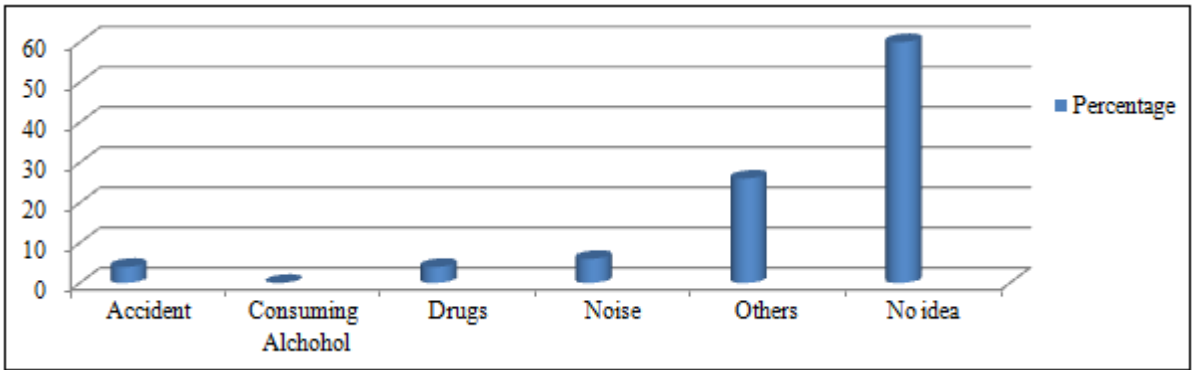

Figure 5

Showing probable causes of tinnitus

Not even a single subject in the present study reported the cause of their tinnitus as consumption of alcohol. Similar observations were reported by [19] 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 is no fluctuation in the pitch of their tinnitus while 68% reported that there is no fluctuation in the loudness of their tinnitus(Table 4). This was in contrast to findings of Kemp and George [10] and Stouffer and Tyler [20] 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.

Table 4: Showing correlations between tinnitus annoyance and distress as well as sleep disturbance caused by it

	Statistical test	My tinnitus has made me feel distressed	My tinnitus has interfered with my sleep
My tinnitus has led me feel annoyed	Pearson correlation	0.623(**)	0.534(**)
		degree of correlation	degree of correlation
	Sig. (2-tailed)	0.000	0.000
		significant at 0.01 level	significant at 0.01 level

** All the correlation are significant at the 0.01 level (2-tailed)

The tinnitus was quantified by deriving means and standard deviations of: (a) four frequency pure tone audiometric thresholds (0.5, 1, 2 and 4 kHz). (b) audiometric measures of tinnitus in forms of TFM (Tinnitus Frequency Matching), TIM (Tinnitus Intensity Matching) and EML (Effective Masking Level). The results are shown in Table 2.

Table 2: Audiological measures of tinnitus

Type of measure	Ear	Mean	Standard deviation	Minimum	Maximum
PTA (0.5, 1, 2 and 4 kHz)	Rt	53.45	17.08	10	70
	Lt	53.42	16.64	12.75	70.25
TFM	Rt	3457.24	2712.62	125	8000
	Lt	3439.1	2464.86	125	8000
TIM	Rt	63.11	14.68	30	90
	Lt	61.71	17.05	30	90
EML	Rt	8.5	12	0	45
	Lt	7.1	8.98	0	45

From the above table it can be summarized that:

- The four frequency PTA ranged from 10 to 70 dBHL with mean of 53.4 dBHL and standard deviation of 17.1

Licensed Under Creative Commons Attribution CC BY

for right ear, and 12.8 to 57.5 dBHL with a mean 53.4 dBHL and standard deviation 16.6 for left ear respectively.

The tinnitus frequency matching has been found to range from 125 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 to 90 dBHL in both ears with mean of 63.1 dBHL and standard deviation of 14.7 in right ear and mean of 61.7 dBHL 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 to 45 dBSL in both ears with mean of 8.5 dBSL and standard deviation of 12 in right ear and mean of 7.10 dBSL and standard deviation of 8.98 in left ear respectively.

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 (1000–3000 Hz), 4—high (4000—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 dBSL and below), 2—faint (5 dBSL), 3—medium (10 dBSL), 4—slightly loud (15 dBSL) and 5—very loud (>20 dBSL). The results are shown in Table 3.

Table 3: Comparison of patient's description of pitch and loudness of tinnitus with that of measured values of pitch and loudness

S. No.	Subject's perception of pitch & loudness of tinnitus	Measured values of pitch and loudness of tinnitus (psychophysical test value)			
		Pitch (Hz)		Loudness (dBSL)	
		Rt	Lt	Rt	Lt
1	High pitch with slightly loud		6000 Hz NBN		10
2	Low pitch with medium loudness	500 Hz (NBN)	500 Hz (NBN)	0	0
3	High pitch with faint loudness		6000 Hz (NBN)		20
4	High pitch with medium loudness		4000 Hz Pure tone		25
5	Low pitch with medium loudness	6000 Hz NBN	6000 Hz (NBN)	20	20
6	Medium pitch with faint loudness	1000 Hz Pulse tone	2000 Hz Pulse tone	5	5
7	Low pitch with faint loudness	250 Hz (NBN)	250 Hz (NBN)	15	20
8	Very low pitch with very faint loudness	125 Hz (NBN)	125 Hz (NBN)	0	5
9	Low pitch with medium loudness	1500 Hz (NBN)		5	
10	Medium pitch with medium loudness		6000 Hz (NBN)		0
11	Low pitch with faint loudness	500 Hz (WBN)		5	
12	Medium pitch with medium loudness	6000 Hz (NBN)	4000 Hz (NBN)	0	0
13	Medium pitch with medium loudness	1500 Hz Pulse tone	500 Hz (NBN)	5	10
14	High pitch with slightly loud	6000 Hz (NBN)	4000 Hz (NBN)	5	0
15	Low pitch with faint loudness	6000 Hz (NBN)	4000 Hz (NBN)	10	0
16	Low pitch with faint loudness	500 Hz (NBN)	500 Hz (NBN)	0	0
17	Low pitch with faint loudness	6000 Hz (NBN)	4000 Hz (NBN)	0	0
18	Very low pitch with faint loudness	2000 Hz (NBN)	500 Hz (NBN)	15	20
19	Low pitch with faint loudness	6000 Hz (NBN)	4000 Hz (NBN)	0	0
20	Very low pitch with faint loudness	500 Hz (NBN)	500 Hz (NBN)	15	0
21	Very high pitch with very loud		8000 Hz (NBN)		0
22	Medium pitch with medium loudness		3000 Hz (NBN)		0
23	Very high pitch with very loud	6000 Hz (NBN)		5	
24	Low pitch with faint loudness		3000 Hz (NBN)		0
25	High pitch with slightly loud	2000 Hz (NBN)		>20	
26	Low pitch with faint loudness	500 Hz (NBN)		0	
27	Very high pitch with very loud	Speech Noise	Speech Noise	>20	>20
28	High pitch with slightly loud	4000 Hz (WBN)	6000 Hz (WBN)	20	>20
29	High pitch with slightly loud	4000 Hz (NBN)	6000 Hz (NBN)	>20	0
30	Low pitch with faint loudness	750 Hz (WBN)	500 Hz (NBN)	0	0
31	High pitch with medium loudness		500 Hz (NBN)		0
32	High pitch with very loud		6000 Hz (NBN)		10
33	High pitch with very loud	500 Hz (NBN)		5	
34	Low pitch with faint loudness		500 Hz Pure Tone		0
35	Very high pitch with very loud	Could not match			
36	High pitch with slightly loud	8000 Hz (NBN)	4000 Hz (NBN)	0	10
37	Medium pitch with slightly loud	1000 Hz (NBN)		10	
38	Very high pitch with slightly loud	500 Hz (NBN)	750 Hz (NBN)	5	0
39	High pitch with slightly loud	750 Hz (NBN)	4000 Hz (NBN)	0	0
40	High pitch with slightly loud	6000 Hz (NBN)	3000 Hz (NBN)	5	10
41	Medium pitch with medium loudness		500 Hz (NBN)		0

Licensed Under Creative Commons Attribution CC BY

42	Medium pitch with medium loudness	3000 Hz (NBN)	1500 Hz (NBN)	5	5
43	High pitch with slightly loud	8000 Hz (WBN)		0	
44	Medium pitch with medium loudness	6000 Hz (NBN)	4000 Hz (NBN)	0	0
45	Very high pitch with very loud	2000 Hz (NBN)		0	
46	High pitch with slightly loud	4000 Hz Warble tone		0	
47	Medium pitch with medium loudness	Speech noise	Speech noise	20	5
48	High pitch with slightly loud	4000 Hz (NBN)	4000 Hz (NBN)	5	0
49	High pitch with slightly loud	Speech noise		10	
50	Low pitch with faint loudness		4000 Hz (NBN)		0

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 Jakes et al. [9], Lindberg et al. [13], Hallam et al. [5], Dineen et al. [2], 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 (Table 3).

Independent Samples Test

Levene's test for equality of variance

	F	Sig.	df	Sig.(2-tailed)
Male	1.702	0.199	42	0.000 (significant)**
Female			41.652	0.000 (significant)**

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

The female had more difficulty getting sleep compared to males as indicated by the mean score (female 1.86, male 1.65) and *t*-test result (*t*-test significant 2-tailed at 0.000 level). Similar study was reported by [3] where female subjects indicating more difficulties in getting to sleep because of tinnitus than male subjects. (Fig.6)

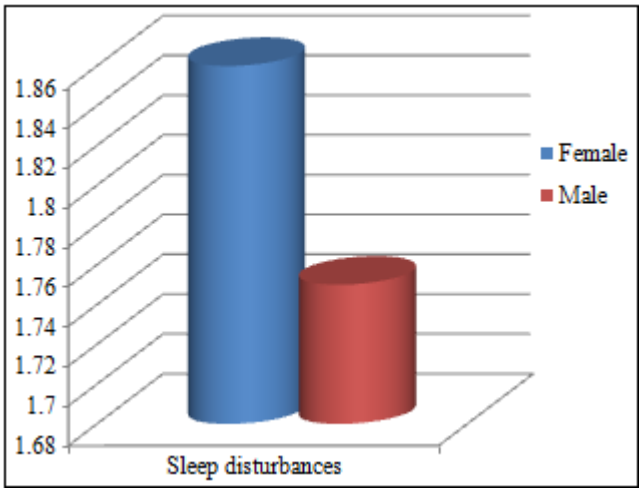

Figure 6

Showing gender differences in difficulties getting to sleep due to 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. This had made female subjects more frustrated than their male counterparts. In contrast to this study, Hallberg and Erlandsson [6] reported no gender differences in regard to psychological reactions to tinnitus, such as interference with concentration, irritability or sleep disturbances. However [3] reported female subjects with a higher level of emotional reaction to their tinnitus as compared to males (Fig. 7).

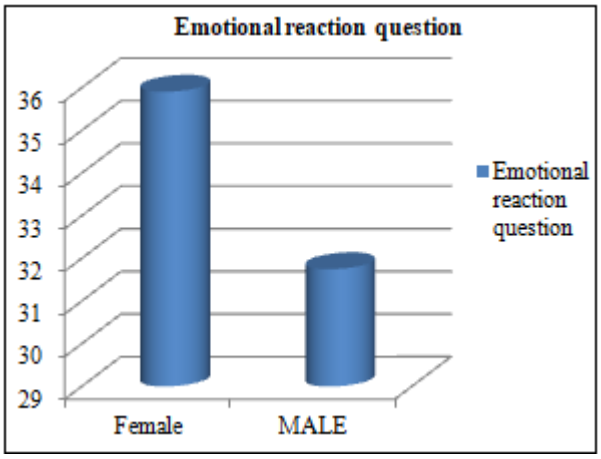

Figure 7

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 (Fig. 7).

The frequency to which tinnitus was matched was higher in female subjects with a mean of 3963.2 and 3602 Hz for right and left ear respectively than their male counterparts with mean of 3047.6 and 3228 Hz for right and left ear respectively. In contrast to this study, Dineen et al. [3] 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 (Fig. 8).

Licensed Under Creative Commons Attribution CC BY

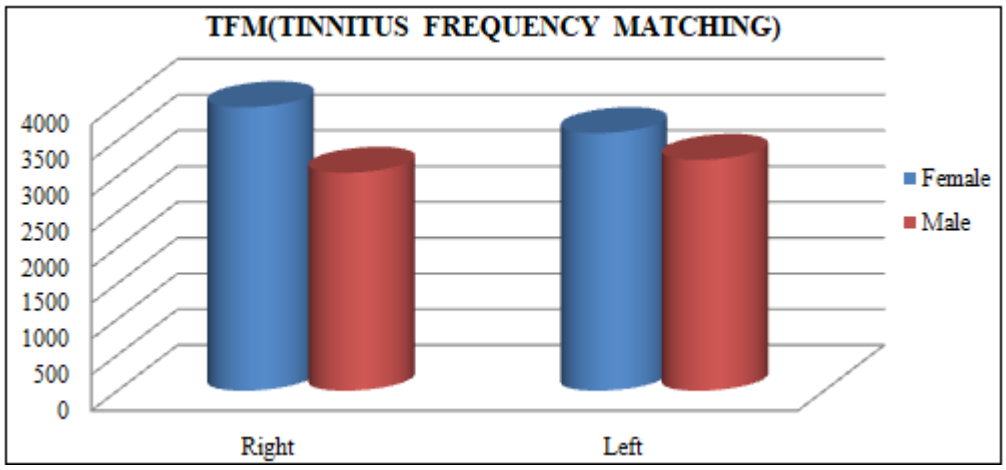

Figure 8

Showing gender differences in tinnitus frequency matching

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, and 59.38 dBHL respectively with that of female mean for right ear and left ear as 64.05 and 63.41 dBHL respectively. Similar findings were reported by Dineen et al. [3] where tinnitus intensity matching was higher in female than male subjects (male mean = 7.5 dBSL, female mean = 10.5 dBSL) (Fig.9)

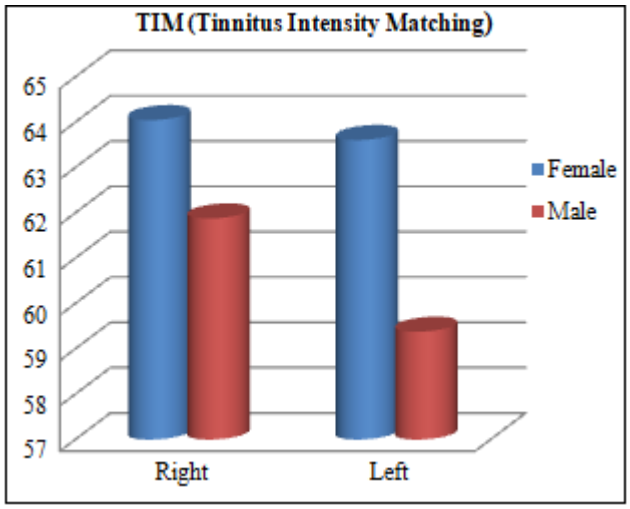

Figure 9

Showing gender differences in tinnitus intensity matching

A significant co-relation has been seen between tinnitus and annoyance as well as distressed and sleep disturbance caused by it. Thus we can infer that tinnitus has disturbed sleep of majority of subjects and made them more annoyed and distressed (Tables 4, 5)

Table 5: Showing correlations between tinnitus distress and sleep disturbance caused by it

	Statistical test	My tinnitus has interfered with my sleep
My tinnitus has made me feel distressed	Pearson correlation	0.536 (**)
		degree of correlation
	Sig. (2-tailed)	0.000
		significant at 0.01 level

** All the correlation are significant at the 0.01 level (2-tailed)

There is 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 (Tables 6).As tinnitus feels more in quite environment.

Table 6: Showing correlations between tinnitus and anger, depression and sleep disturbance caused by it

	Statistical test	My tinnitus has led me feel depressed	My tinnitus has interfered with my sleep
My tinnitus has made me feel angry	Pearson correlation	0.524(**)	0.483(**)
		degree of correlation	degree of correlation
	Sig. (2-tailed)	0.000	0.000
		significant at 0.01 level	significant at 0.01 level

** All the correlation are significant at the 0.01 level (2-tailed)

Table 7: Showing correlations between tinnitus and depression and sleep disturbance caused by it

	Statistical test	My tinnitus has interfered with my sleep
My tinnitus has led me feel depressed	Pearson correlation	0.612(**)
		degree of correlation
	Sig. (2-tailed)	0
		significant at 0.01 level

** All the correlation are significant at the 0.01 level (2-tailed)

However, no significant co-relation was seen between distressed caused by tinnitus and duration of tinnitus (−0.034). 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. Hallam et al. [4] 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 (Table 8).

Licensed Under Creative Commons Attribution CC BY

Table 8: Showing relationship between degree of tinnitus and its durations

Impact of tinnitus reaction	Statistical test	Duration of tinnitus
My tinnitus has made me feel distressed	Pearson correlation	- 0.034
		degree of correlation
	Sig. (2 tailed)	0.813
		Not significant

The multiple nature/sounds of tinnitus has far more devastating effects or serious impact on 'tinnitus sufferers' than the single sound/nature (Table 9).

Table 9: Showing Tinnitus Reaction Questionnaire Score for nature of tinnitus

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
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
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
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	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

5. Conclusions

A significant co-relation has been found between tinnitus and annoyance as well as distress suggested that annoyance and distressed lead to tinnitus. A significant correlation was also found between the impact of tinnitus and disturbance of sleep indicated that disturbance of sleep precipitate the tinnitus with increase in depression and anger. No significant co-relation was seen between annoyance, distress caused by tinnitus and duration of tinnitus indicate that habituation does not occur in those who are annoyed and distress. The multiple nature/sounds of tinnitus have been found to have far more devastating effects on 'tinnitus sufferers' than the single sound/nature.Significant morbidity associated with multiple nature/sound tinnitus.

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. Thus affecting their social, personal, cultural and intellectual life

Female subjects were found to have more difficulties in getting to sleep because of tinnitus than their male counterparts. Female subjects also reported their tinnitus as more often like complex sounds, than their male counterparts. Female subjects also reported a higher level of emotional reaction to their tinnitus as compared to males. This has made female subjects more frustrated than their male counterparts.

Longitudinal study will give more comprehensive result on the Impact of Tinnitus on Sufferers. These studies would further help in the overall management of the patient suffering from tinnitus.

6. Acknowledgment

I have no words to express my gratitude to my seniors and colleagues

Appendix 1

Nature of Tinnitus Questionnaire
Name of the subject:
Age & Gender:
Date of tinnitus assessment
1)Duration of tinnitus (6 month/1 year/pl. specify - - - - - - -)

2)Where is your tinnitus?
☐ Lt ear
☐ Rt ear
☐ Both ears, equally
Any other - - - - - - -

3)Describe the most prominent pitch of your tinnitus.
☐1 ☐2 ☐3 ☐4 ☐5
1—very low (below &250 HZ), 2—low (500 HZ), 3—medium (1000–3000 HZ), 4—high (4000–6000 HZ), 5—very high (>6000 HZ)

4)Does the pitch of tinnitus fluctuating? (In a day i.e. within 24 h it increases or decreases more than two times)
☐ Yes
☐ No
If yes give details - - - - - - -

5)Describe the loudness of your tinnitus.
☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
1—very faint (below &0 dBSL), 2—faint (5 dBSL), 3—medium(10 dBSL), 4—loud(15 dBSL), 5—very loud (>20 dBSL).

Licensed Under Creative Commons Attribution CC BY

6) Does the loudness of tinnitus fluctuating? (In a day i. e. within 24 h it increases or decreases more than two times).
☐ Yes
☐ No
If Yes Give Details - - - - - - -

7) Which of following qualities best describes your tinnitus?
☐ Buzzing
☐ Hissing
☐ Humming
☐ Ringing
☐ Whistling
Any other, pl specify - - - - - - -

8) When you have your tinnitus, which of the following makes it worse? (Tick all of these that apply to you)
☐ Consuming Alcohol
☐ Being in a noisy place
☐ Being in a quite place
☐ Changing head position
☐ Consuming Tea/Coffee
☐ Consuming Drugs/Medicine
☐ Lack of sleep
☐ When you are excited
☐ Early in the morning
☐ Nothing above makes it worse.
Any other please specify - - - - - - -

9) According to you what are the probable cause of your tinnitus?
☐ Accident
☐ Consuming Alcohol
☐ Consuming Drug/Medicine
☐ Noise Exposure
☐ Smoking
☐ Surgery
Any other please specify - - - - - - -

I have no idea.

Appendix 2
Tinnitus Reaction Questionnaire
Name:
Age/Sex:
Occupation:

Following are the statements describing the possible reactions to your tinnitus. Mark any number between 0 and 4 that best describes the reaction to your tinnitus.

The numbers from 0 to 4 are described as follows:
- 0 – Not at all.
- 1 – Little of the time
- 2 – Some of the time
- 3 – A good deal of the time
- 4 – Almost all of the time

S. No	Statements	Scales			
		1	2	3	4
1	My tinnitus has made me unhappy				
2	My tinnitus has made me feel tense				
3	My tinnitus has made me feel irritable				
4	My tinnitus has made me feel angry				
5	My tinnitus has led me to cry				
6	My tinnitus has led me to avoid quiet situations				
7	My tinnitus has made me feel less interested in going out				
8	My tinnitus has made me feel depressed				
9	My tinnitus has made me feel annoyed				
10	My tinnitus has made me feel confused				
11	My tinnitus has ‘driven me crazy’				
12	My tinnitus has interfered with my enjoyment of life				
13	My tinnitus has made it hard for me to concentrate				
14	My tinnitus has made it hard for me to relax				
15	My tinnitus has made me feel distressed				
16	My tinnitus has made me feel helpless				
17	My tinnitus has made me feel frustrated with things				
18	My tinnitus has interfered with my ability to work				
19	My tinnitus has led me to despair				
20	My tinnitus has made me to avoid noisy situations				
21	My tinnitus has made me to avoid social situations				
22	My tinnitus has made me feel hopeless about the future				
23	My tinnitus has interfered with my sleep				
24	My tinnitus has led me to think about suicide				
25	My tinnitus has made me feel panicky				
26	My tinnitus has made me feel tormented				

References

[1] Coles RRA (1984) Epidemiology of tinnitus (2) Demographic and clinical features. J Laryngol Otol supplement 9:195–202. (Cited in Rosenhall U, Karlsson A (1991) Tinnitus in old age. Scand Audiol 20:165–171)
[2] Dineen R, Doyle J, Bench J (1993) Coping strategies: an approach to understanding how people manage tinnitus. (Cited in Dineen R, Doyle J, Bench J (1997) Managing tinnitus: comparison of different approaches

Licensed Under Creative Commons Attribution CC BY

to tinnitus management training. Br J Audiol 31:27–38)

[3] Dineen R, Doyle J, Bench J. Audiological & Psychological characteristic of a group of tennitus sufferer, prior to the tinnitus management training. Br J Audiol. 1996;31:27–38. doi: 10.3109/03005364000000006. [PubMed] [CrossRef] [Google Scholar]

[4] Hallam RS, Rachman S, Hinchecliffe R (1984) Psychological aspects of tinnitus. In Rachman S (ed) Contributions of medical psychology. Pergamon Press, Oxford, pp 31–53 (In Dineen R, Doyle J, Bench J (1997) Managing tinnitus: a comparison of different approaches to tinnitus management training. Br J Audiol 31:331–334)

[5] Hallam RS, Jakes SC, Hinchcliffe R (1988) Cognitive variables in tinnitus annoyance. Br J Clin Psychol 27:213–222 (Cited in Dineen R, Doyle J, Bench J (1997) Managing tinnitus: a comparison of different approaches to tinnitus management training. Br J Audiol 31:27–38)

[6] Hallberg LR-M, Erlandsson SI (1993). Tinnitus characterisitics in tinnitus complainers and non complainers. Br J Audiol 27:19–27 [PubMed]

[7] Henry JA, Loovis C, Montero M, Kaelin C, James K (2007) Based on tinnitus retraining therapy. J Rehabil Res Dev 44(1):21–32 [PubMed]

[8] House JW, Brackman DE. Tinnitus: surgical treatment. In: Evered D, Lawreson G, editors. Ciba foundation symposium 85: tinnitus. London: Pitman; 1981. pp. 204–211. [Google Scholar]

[9] Jakes SC, Hallam RS, Rachman S, Hinchliffe R (1986) The effect of reassurance, relation training and distraction on chronic tinnitus sufferers. Behav Res Ther 24:497–507 (Cited in Kemps S, George RN (1992) Diariesof tinnitus sufferers. Br J Audiol 26:382–386)

[10] Kemps S, George RN. Diaries of tinnitus sufferers. Br J Audiol. 1992;26:382–386. [PubMed] [Google Scholar]

[11] Kirsch CA, Blanchard EB, Parnes SM (1989) Psychological characteristics of individual high and low in their ability to cope with tinnitus. Psychosom Med 51:209–217 (Cited in Dineen R, Doyle J, Bench J (1997) Managing tinnitus: a comparison of different approaches to tinnitus management training. Br J Audiol 31:27–38)

[12] Lindberg P, Lyttkens L, Melin L, Scott B. Tinnitus incidence and handicap. Scand Audiol. 1984;13:287–291. doi: 10.3109/01050398409042138. [PubMed] [CrossRef] [Google Scholar]

[13] Lindberg P, Scott B, Melin L, Lyttkens L (1987) Long terms effect of Psychological treatment of tinnitus. Scand Audiol 16:167–172 [PubMed]

[14] Longridge NS (1981) A tinnitus clinic. J Otolaryngol 8(5):390–395 (Cited in Slater R, Terry M (1987). Tinnitus: definitions, causes and theories of tinnitus. Croomhelm, USA pp 167–176)

[15] Meikle M, Taylors Walsh E (1984) Characteristics of tinnitus and related observations in over 1800 tinnitus clinic patients. In: Proceedings of the second international tinnitus seminar, Supplement 90, pp 17–21 (Cited in Van ED, Jacobs JB, Bensing JM (1998) Assessment of distress with tinnitus. J Laryngol Otol 112:258–263)

[16] National Centre for Health Statistics (1980) Basic data on hearing levels of adults, 25–74 years. United States, 1971–1975. Vital and health statistics publication series, 11, No. 215 (Cited in Van ED, Jacobs JB, Bensing JM (1998) Assessment of distress associated with tinnitus. J Laryngol Otol 112:258–263)

[17] Slater R, Terry M. Tinnitus: definitions, causes and theories of tinnitus. USA: Croom Helm; 1987. pp. 132–142. [Google Scholar]

[18] Slater R, Terry M. Tinnitus: a guide for sufferers and professional. London: Croom Helm Ltd; 1987. [Google Scholar]

[19] Spitzer JB. Auditory effects on chronic alcoholism. Drug Alcohol Depend. 1981;8(4):317–335. doi: 10.1016/0376-8716(81)90041-7. [PubMed] [CrossRef] [Google Scholar]

[20] Stouffer JL, Tyler RS. Characteristics of tinnitus by tinnitus patients. J Speech Hear Disord. 1990;55:439–453. [PubMed] [Google Scholar]

[21] Tyler RS, Baker LJ. Difficulties experienced by tinnitus sufferers. J Speech Hear Disord. 1983;48:150–154. [PubMed] [Google Scholar]

[22] Wilson PH, Henry J, Bowen M, Haralambous G (1991) Tinnitus Reaction Questionnaire: psychometric properties of a measure of distress with tinnitus. J Speech Hear Res 34:197–201 [PubMed]

Licensed Under Creative Commons Attribution CC BY