==========
Language in India www.languageinindia.com **ISSN 1930-2940 Vol. 19:3 March 2019**
India's Higher Education Authority UGC Approved List of Journals Serial Number 49042
==========

Reduced Tolerance to Sounds Among Youngsters

Dr. Binoy Shany, M S., Ph.D.
Professor
Marthoma College of Special Education
Institute of Speech & Hearing
Badiadka, Kasaragod-671551
Shany003@yahoo.com

Revathy Suresh, MASLP
Marthoma College of Special Education
Institute of Speech & Hearing
Badiadka, Kasaragod-671551
revathysuresh@gmail.com

==========

Introduction

Hyperacusis is a condition in which exposure to everyday sounds is perceived as more annoying which resulting in symptoms such as a headache, fatigue, and concentration difficulties. People who are having hyperacusis may even find normal environmental sounds to be too loud. Hyperacusis is a disorder of loudness perception, in which sound intensities that are considered comfortable by most people are perceived unbearably loud (Baguley, 2003).

"Hyperacusis is an abnormally strong reaction to sounds occurring within the auditory pathways." Jastreboff & Hazell (2004). The perception of intense sound by listeners with normal hearing was described as a "tickle" by the authors Von Bekesy in1936 and Silverman, Harrison, & Lane in 1946, a "discomfort" (Wegel, 1932), and a "pain" by Cox in 1981. Many authors have given different descriptions for hyperacusis. Phillips & Carr, (1998) defined hyperacusis as a heightened awareness of sounds.

Hyperacusis does not indicate a higher than normal threshold sensitivity to sound, nor loudness recruitment (Tyler & Conrad-Armes, 1983). In the case of hyperacusis, sounds are not simply a bit loud, but truly unbearable. Hyperacusis can occur without a loss of hearing thresholds (Gu, Halpin, Nam, Levine & Melcher, 2010). A person with hyperacusis will have a wide range of symptoms such as difficulty tolerating normal sounds like the noise from running faucet water, riding in a car, walking on leaves, dishwasher, fan on the refrigerator, shuffling papers etc. But the characteristics and severity of the problem may vary among individuals. Hence the individuals with hyperacusis have problem in perceiving normal environmental sounds in their day to day life, there will be a strong impact on their quality of life, and it leads to changes in their behaviors like avoiding loud situations, social interactions, public transport, all of which impede the patients' ability to lead a normal life (Sheldrake, Diehl, & Schaette, 2015).

And in addition, hyperacusis may have a negative impact on a patient's emotional well-being, sleep, and concentration. (Tyler et al., 2014). Because of a wide range of symptoms that shown by

individuals with hyperacusis it has been defined in several different ways in the literature including as auditory hypersensitivity, hyperresponsiveness to sound, phonophobia, and misophonia. Although phonophobia (fear of sound) and misophonia (severely negative reactions to specific "trigger" sounds) are sometimes used in the place of hyperacusis, both these conditions describe aversive emotional responses to sounds.

Tyler et al., 2014 focused on loudness, annoyance, fear, and pain as the different forms of hyperacusis and he stated that individuals with hyperacusis can experience these different reactions individually or in combination. Due to the differences in assessment procedures applied and the lack of a clear definition for hyperacusis, prevalence rates reported in the literature vary.

Studies conducted in Sweden (Widen & Erlandsson, 2004) and Poland (Fabijanska, Rogowski, Bartnik, & Skarzynski, 1999) reported the prevalence of hyperacusis as 8.6 and 15.2% respectively. Hyperacusis shows a high degree of co-morbidity with the phantom auditory sensation of tinnitus. It is estimated that 86% of hyperacusis patients also perceive tinnitus. (Anari, Axelsson, Eliasson & Magnusson, 1999). Statistics on hyperacusis are too little, and although it is often coincident with tinnitus, limited evidence has supported the co-occurrence of the two conditions (Andersson, Lindvall, Hursti & Carlbring 2002; Gu et al., 2010; Nelson & Chen, 2004). With an approximate prevalence of about 10–15% of the population (Gilles et al., 2012), the prevalence of hyperacusis is comparable to tinnitus (Shargorodsky, Curhan, Curhan & Eavey, 2010).

Hypersensitivity to sound can have an extremely strong impact on patient's lives. It can prevent people from exposing themselves to louder environments and it can prevent people from working and interacting socially. Importantly, it can prevent patients from enjoying a variety of life activities. In extreme cases, decreased sound tolerance can totally control a patient's life. In these cases, patients do not leave their homes. Their lives and the lives of their families are totally controlled by the issue of avoidance of sound (Jastreboff & Jastreboff, 2001).

The possible etiologies for hyperacusis are still not understood clearly (Katzenell & Segal, 2001). Goodson, (2015) have explained some of the diseases in which we can see hyperacusis. And it includes Bell's palsy, chronic fatigue syndrome, Lyme disease, Meniere's disease, Post-traumatic stress disorder, Depression, and Autism. Additionally, hyperacusis is seen in patients who have experienced head trauma, such as airbag deployment, surgery to the jaw or face, or a viral infection of the inner ear. One major cause of hyperacusis is loud noise exposure. It may be triggered by a single intense noise.

People those who are exposed to loud levels of noise through their occupation, whether as a machinist or a musician, should be protective of their hearing to avoid noise-induced hearing loss and other changes in their hearing such as tinnitus or hyperacusis. Hyperacusis can be seen in all age groups. But it was stated that the patients suffering from hyperacusis are relatively young as compared to the patients suffering from tinnitus or the individuals suffering from a noise-induced hearing loss (Anari et al., 1999). Young people are often exposed to high music levels which make them more at risk to develop noise-induced symptoms such as hearing loss, hyperacusis, and tinnitus of which the latter is the symptom perceived the most by young adults (Gilles et al., 2016).

From the studies conducted in young adults it says that youngsters are at a risk of experiencing auditory problems such as hearing loss, tinnitus, or hyperacusis as a result of their health risk behaviors, for example, exposing themselves to loud levels of sounds and listening to loud music through headphones (Chung, Roches, Meunier & Eavey, 2005). Hence hyperacusis more prone to have in youngsters, the assessment of the hyperacusis in this population is very important. But there is no standard objective method for the assessment of the hyperacusis. Most of all the individuals with hyperacusis will have normal hearing thresholds (Anari et al., 1999).

Hyperacusis is a highly subjective phenomenon (Wallen, Hasson, Theorell & Canlon, 2012) hence the patient's description of the condition is very important in the assessment of hyperacusis. So questionnaires are the easy tools that can be used to obtain information about the characteristics and severity of the symptoms that are related to hyperacusis. And questionnaires are an easy tool to evaluate young adults who may be unaware of their discomfort for sounds.

Need for the Study

There are different western studies in the literature regarding hyperacusis which talks about the nature and characteristics of hyperacusis. There are also studies regarding the music listening habits, use of headphones, noise-induced hearing loss etc. and its effect on auditory function in young adults. Young adults are more exposed to noise through personal amplification systems, headphones and all, and there are more prone to have hyperacusis. Since there are only very few Indian studies regarding hyperacusis in young adults, the present research is to study the reduced tolerance of sounds in young adults.

Review of Literature

Hyperacusis is one of the common problems that seen in most of all the people and it is associated with concentration difficulties, use of ear protection, avoidance, tension, and sensitivity to light/colors (Andersson et al., 2002). Noise exposure is one of the important causative factors of hyperacusis. Most of the individuals experience a negative emotional response to noise exposure and the responses may be much more than the annoyance. Reactions to noise exposure may include frustration, depression, anger, exhaustion etc. (Soames, 1999).

Studies show that hyperacusis can be seen in all the age groups. Coelho, Sanchez & Tyler (2007) did a study on 506 children reported that; children were affected by hyperacusis. 42% of the children were upset by sounds and 3.2% had hyperacusis. 50% of the children were reported to have tinnitus. Individuals who reported to have tinnitus and hyperacusis have often associated with a history of traumatic acoustic overexposure, some have clinically normal thresholds (Anari et al., 1999; Brandy & Lynn 1995; Coelho et al. 2007; Schmuziger et al., 2006), suggesting that all these perceptual problems can arise through peripheral damage that is undetected by standard audiometry. Hyperacusis shows a high degree of co-occurrence with tinnitus. It is estimated by Anari et al., in 1999 that 86% of hyperacusis patients also perceive tinnitus.

Gothelf, Farber, Raveh, Apter, & Attias (2006) conducted a study in individuals with William's syndrome. In the study, 49 subjects have participated. Mothers of each subject with hyperacusis were asked to complete the hyperacusis screening questionnaire. Those who were having hyperacusis underwent audiological and brain auditory evoked response testing. Results show that 41 out of 49 children with William syndrome (84%) had hyperacusis. Subjects with William syndrome

reported have discomfort in high sound intensities. They concluded that hyperacusis in William syndrome was having a similar configuration of noise-induced hearing loss.

Klein, Armstrong, Greer & Brown (1990) also evaluated Hyperacusis in children with Williams Syndrome using Parental questionnaires. Children with 95% of children with Williams syndrome were having hyperacusis. Wallen et al., (2012) did a study in order to validate the hyperacusis questionnaire (HQ) in different levels of emotional exhaustion. HQ-scores and uncomfortable loudness levels were of 348 individuals were found out with low, intermediate, and high emotional exhaustion-levels. 1.1% of subjects met the critical value for hyperacusis according to the HQ. All correlations were negative, indicating that higher hyperacusis questionnaire scores are correlated with lower uncomfortable loudness levels.

Khalfa et al., (2004) have done a study in autistics with respect to subjective perception of loudness compared to healthy controls. They used 2 psychoacoustic tests. First, the auditory dynamic range was evaluated. Secondly, loudness growth as a function of the intensity level was estimated. Verbal responses from a group of 11 children and adolescents with autism were compared to responses of the control group. Uncomfortable loudness level and dynamic range were small in the autistic group, as well as the increased perception of loudness indicate hyperacusis in subjects with autism.

Dauman & Bouscau-Faure (2005) did the assessment of hyperacusis in tinnitus patients to find out the relationships between hyperacusis. All tinnitus patients seen over a period of 16 months were assessed using (i) a scale ranging from 0 to 10 for assessing the annoyance of tinnitus and the overall annoyance of hyperacusis and (ii) the newly introduced multiple-activity scale for hyperacusis. Tinnitus was greater in females. The prevalence of hyperacusis was high (79%). The annoyance of hyperacusis varied among subjects. Individuals with severe hyperacusis were younger than those in the other groups. The Correlation was poor between the annoyance of tinnitus and the annoyance of hyperacusis.

Study of the relationship between the degree of tinnitus annoyance and the presence of hyperacusis was done by Guimaraes et al., (2014) to evaluate the prevalence of hyperacusis in patients with tinnitus and its relation to the annoyance of tinnitus**.** A questionnaire and audiological evaluation of tinnitus and hyperacusis were done. Using a visual analogue scale the degree of annoyance of tinnitus and hyperacusis was measured. Hyperacusis was present in 18.4% of patients. The degree of annoyance in tinnitus patients with hyperacusis was similar to that of patients without hyperacusis. Hyperacusis was present in 18.4% of patients with tinnitus. There was no correlation between the degrees of annoyance due to tinnitus with the presence of hyperacusis.

Blomberg, Rosander & Andersson (2006) conducted a study to find out the possible connections between fear, hyperacusis, and musicality in a Swedish sample of individuals with Williams's syndrome. The study included 38 individuals. Results revealed that female participants were having high fears and hyperacusis. They concluded that fears and anxiety could be associated with hyperacusis in the William syndrome population, and musicality could serve as a protective factor and prevent anxiety.

Clark (1998) studied the effect of leisure noise on hearing. He said that exposure to amplified rock, classical or jazz music; exposure from personal listening devices, the noise around the home, hunting and target shooting sounds are the most sources of leisure noises and he also reported that all these activities have a potential for dangerous levels of noise exposure and can cause a threat to hearing.

Stansfeld (1992) reported that noise is one of the environmental stress factors which may lead to emotional symptoms. And also, associations between noise exposure and changes in performance, sleep disturbance and emotional reactions such as annoyance. Noise sensitive people attend more to noise and they get annoyed by noise very easily and find noises more threatening and out of their control, and react to, and adjust to noises more slowly.

Beutel et al., (2016) did a study to find noise annoyance associated with depression and anxiety in the general population. They reported that the degree of anxiety and the depression increased with noise annoyance. Hasson, Theorell, Bergquist, & Canlon (2013) studied stress induced hyperacusis in women with emotional exhaustion. Uncomfortable loudness level was found out before and after giving an acute stress task for the assessment of hyperacusis. Results of this study indicate that after giving the acute stress task there was a significant difference in levels of uncomfortable loudness level in emotionally exhausted women. They concluded that women with a high level of emotional exhaustion become more sensitive to sounds after exposing to an acute stress task.

Smith et al., (1986) compared the self-reported everyday problems of people who are living in the area with a high level of aircraft noise. Subjects were divided into 2 groups like people who are more sensitive to sounds and people who are less sensitive to sounds. Results of this study reveal that people who were having high sensitivity towards the noise was having a problem with everyday activities and there was no interaction between noise sensitivity and the level of aircraft noise.

Shepherd, Welch, Dirks & Mathews (2010) conducted a study in adults who are residing near the airport to find out the relationship between noise sensitivity, noise annoyance and health-related quality of life. A survey was conducted among participants to measure the noise sensitivity, noise annoyance and quality of life. The results revealed that noise sensitivity was associated with health-related quality of life. And they concluded that annoyance and sleep disturbance due to the noise exposure mediated the effects on health.

Lee et al., (2014) did a study in young adults of Singapore and reported that one in six young persons is at risk of developing leisure Noise-induced hearing loss (NIHL) from music delivered via earphones and the extent of the problem of leisure NIHL may be even greater. Adolescents are exposed to high music levels such as concerts, nightclubs, sports events, pubs, bars, etc., due to the large amount of social activities the younger population is at risk to develop noise-induced symptoms such as hearing loss, hyperacusis, and tinnitus (Serra et al., 2005) and (Beach, Williams, & Gilliver, 2013).

Smith**,** Davis**,** Ferguson & Lutman (2000) also studied the type of social noise exposure in young adults in England. And their results also suggest that young adults have been exposed to noise from different social activities compared with other occupational noise and gunfire noise. Most of

the young adults who reported they were attending nightclubs and rock concerts were having temporary effects on their hearing.

Hellstrom, Axelsson & Costa (1998) studied the temporary threshold shift induced by the music in youngsters. Youngsters with different music listening habits were allowed to listen to their own choice of music for 1 hour. Temporary threshold shift induced by the music was noted. And results show that female participants were having more temporary shift due to noise exposure than males. The temporary shift also different for subjects with different listening habits.

Zhao, Manchaiah, French & Price (2009) reported that excessive exposure to loud music can cause hearing problems and may lead to noise-induced hearing loss. Nowadays adolescents and young adults are exposing themselves to music on a voluntary basis at potentially harmful levels which may lead to noise-induced hearing loss.

Vogel et al., (2009) did a study to assess the risky and protective listening behaviors of adolescent users of MP3 players. The result suggested that most of the participants were frequently using earphones to listen to MP3 players and most of them used high volume settings and only a few participants were reported to use noise limiters. They concluded that adolescents are more likely to engage in risky listening behaviors and are unlikely to take protection.

From the studies that have reported earlier in youngsters regarding the music listening habits and sound intolerance problems it is clear that young population are more exposed to different kinds of noises through the use of personal listening devices, attending to DJs, rock music, concerts etc. and due to these kinds of social activities and noise exposure in youngsters they are more likely to have sound intolerance problems. So, the studies regarding the hazardous noise exposure and its consequences may provide the youngsters with awareness about these problems particularly, in the Indian context.

The Aim of the Study

- To study the reduced sound tolerance among youngsters using hyperacusis questionnaire.
- To study the gender difference in hyperacusis among youngsters.

Method

Participants

A total of 750 college students whose age ranges between 18 to 25 years from 5 different colleges of Ernakulum from the urban area were selected for the study. The number of male students and female students was equal (375 girls and 375 boys). All the students participated were native speakers of Malayalam. All the Subjects will be provided with verbal information about the study. Ethical committee clearance was taken for the study and confidentiality and privacy of the participants was also maintained. The subjects who had hearing loss and any other metabolic or neurological problems were excluded from the study.

Material

Modified Khalfa Hyperacusis Questionnaire given by Khalfa et al (2002) was used to assess the hyperacusis in youngsters. The questionnaire was in English and it was used in many studies for the assessment of hyperacusis and it was available on the internet. In the current study the English

questionnaire was translated into Malayalam by a person proficient in both Malayalam and English, and then the questionnaire was verified and validated by 10 Audiologist.

The Modified Khalfa Hyperacusis Questionnaire consists of total 20 questions and the questions were divided into 3 subscales namely 1. Functional, 2. Social and 3. Emotional. Functional subscale consists of 7 questions, Social subscale consists of 6 questions and Emotional subscale consists of 7 questions.

Procedure

The researcher distributed the questionnaires among the college students whose age range between 18 to 25 years. For the recording purpose and to get the basic information about the participant, the subjects were asked to fill their name, age, and gender. The participants were asked to fill the questionnaire. Subjected were instructed to mark their responses for each question and it should be completely based on their personal opinion. Subjects were asked to mark their responses on a 3-point rating scale. The rating of each question was "*yes*", "*sometimes*" and "*no*". A maximum score of 5 was given to the response "*yes*", score 3 was given to the response "*sometime*s" and the response "*no*" was scored as 0.

The possible total index score was 100 and the severity of the hyperacusis was determined on the basis of the total score. Subjects who scored "0 to 10" total score were considered as normal (no hyperacusis) and those who scored above 12 were considered as having Hyperacusis. Subjects who scored total score 12 to 40 score were considered as having Mild hyperacusis, total score 42 to 60 was considered as having Moderate hyperacusis and total a score of 62 to 100 was considered as having Severe hyperacusis.

Data analysis

Collected data were statistically analysed in order to find out the reduced tolerance of sounds among youngsters across the functional, social and emotional domain. Comparison across the gender was also done to check whether hyperacusis is more common in males or females.

Results and Discussion

The aim of the study was to study the reduced tolerance to sounds among youngsters. The present research was conducted among college students using a questionnaire and the scores obtained were subjected to statistical analysis. The responses of the subjects towards the intolerance to sounds were rated under three subscales; Functional subscale, Social subscale and Emotional subscale and the results are discussed in the following sections.

1) ***Hyperacusis among youngsters:***

Based on the total score of the modified hyperacusis questionnaire severity of hyperacusis for each participant was found out. And the total mean score of each participant was calculated to find out the percentage of the severity of hyperacusis.

Severity	Frequency	Percent

Normal	60	8.0
Mild	537	71.6
Moderate	136	18.1
Severe	17	2.3
Total	750	100.0

Table-1: Indicates the percentage of participants based on the severity

The table - 1 shows the total number of participants and its percentage based on the severity. And it says that out of 750 participants only 60 participants that is 8% of the participants were normal (those who scored below 10). 537 participants (92%) were reported to have hyperacusis (those who scored above 12). Majority of the participants, that is 72% were scored between 12 and 40 indicating mild hyperacusis.18% of the participants scored between 42 and 60 indicating moderate hyperacusis. Only 2% of the participants scored above 62 which indicate severe hyperacusis.

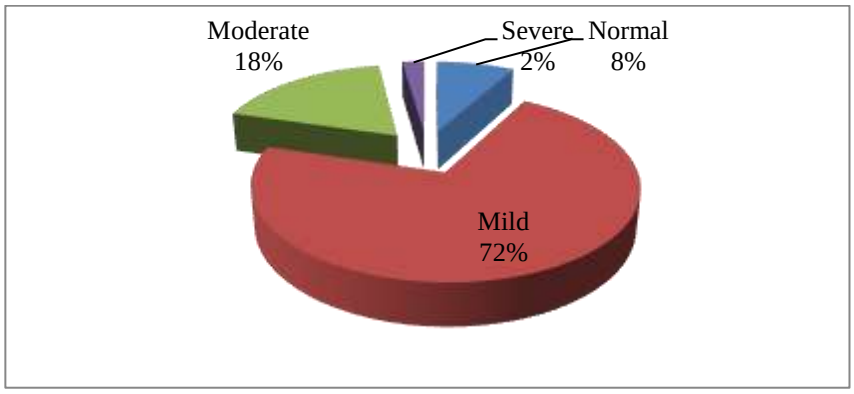

Figure - 1 shows the percentage of the severity of hyperacusis

Figure - 1 show that most of the subjects participated in the study reported having hyperacusis indicating that sound tolerance is a common problem seen in youngsters.

2) Gender comparison:

Total mean scores and scores of each subscale of males and females were calculated and comparison of total score across gender was done and also gender comparison across each subscale was done using the Chi-square test.

	Severity			
Gender	Normal	Mild	Moderate	Severe
Male	13.9%	70.1%	14.7%	1.3%
Female	2.1%	73.1%	21.6%	3.2%

Table-2: Indicates the percentage of males and females based on the severity

From the table - 2, 13.9% of the males were reported to have normal sound tolerance. And only 2.1% of the females were reported to have normal sound tolerance. Most of the participants were having mild hyperacusis, 70.1% males and 73.1% of females were reported to have mild hyperacusis. Only 14.7% of males were reported to have moderate hyperacusis whereas 21.1% females were having moderate hyperacusis. Only a few participants were reported to have severe hyperacusis out of that 3.2% of the participants were females and 1.3% of the participants were males. The score of female participants was higher than males. And only a few females were reported to have normal sound tolerance, whereas scores of males were low compared to scores of females and 13.9% of the males were reported to have normal sound tolerance. So these results indicate that females are having more problems with tolerating sounds than males.

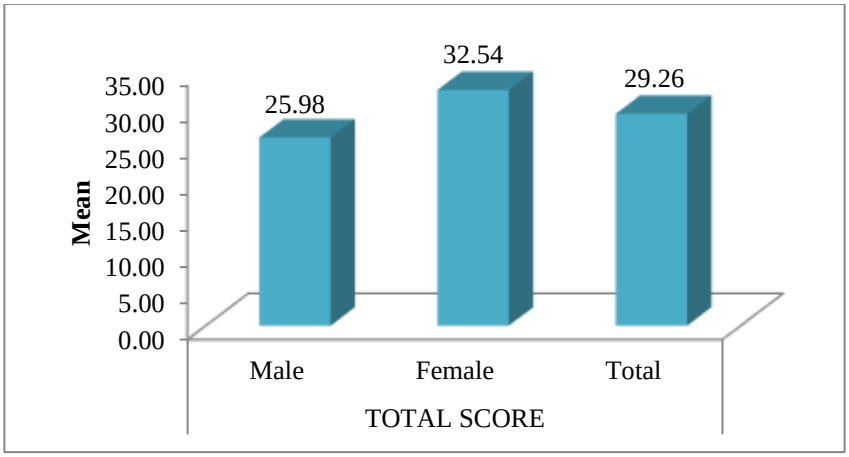

Figure-2: Shows the difference in total scores of males and females

The figure - 2 shows the difference in total scores of males and females. The x-axis denotes scores of males and females and the total score and the y-axis includes the total mean scores. The total mean score of females was 32.54 and it is higher than mean scores of males which is 25.98. So, these scores from figure indicate that females are having more sound tolerance problems than males. Total scores of males and females were compared using the Chi- Square test to check whether there is any significant difference between the scores of males and females and the results shows that there is a highly significant correlation between the scores of males and females with p-value 0.000. Gender difference across the subscales was also checked to found out whether functional, social or emotional problems have an impact on sound tolerance.

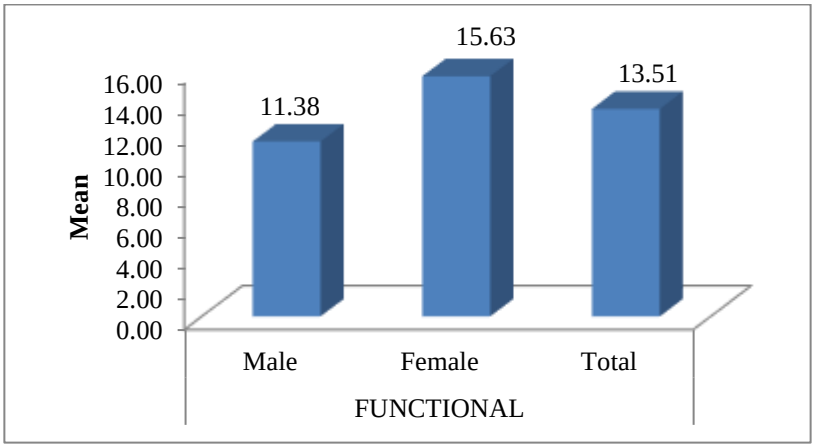

Figure-3: Shows the difference in scores of males and females in functional subscale

In the figure -3, the x-axis denotes the total scores obtained by males and females and the y-axis denotes the total mean scores. The total mean score for the male in functional subscale is 11.38 and the total mean score of functional subscale for the female is 15.63. From the figure, it is clear that both males and females are having the functional problem and compared to males females are having more functional problems than males. These results indicate that reduced tolerance to sounds causes functional problems and it has an impact on their everyday situations.

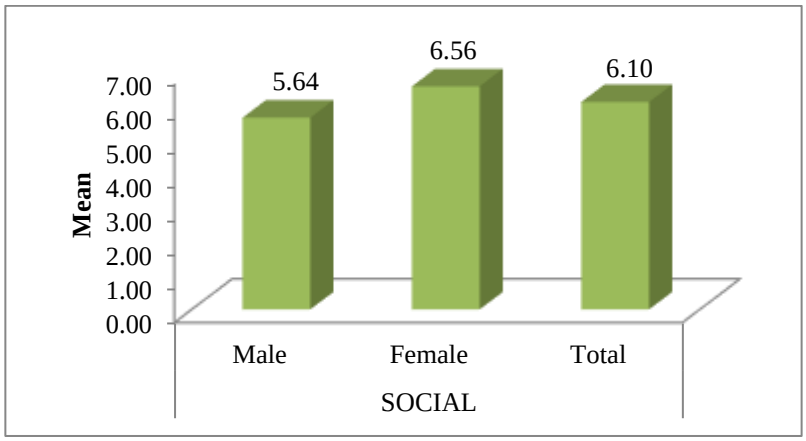

Figure-4: Shows the total mean score of social subscale for males and females

The figure-4 shows the difference in total mean scores of social subscale for males and females. The x-axis shows the variable male and female and the y-axis shows the total mean scores. Total mean scores of social sub-scale for males is 5.64 and for females is 6.56 which says that both males and females are having social problems due to reduced sound tolerance and it indicates that reduction in the sound tolerance may have an impact on the day to day life. From the scores of males and females, we can say that females are having more social problems than females.

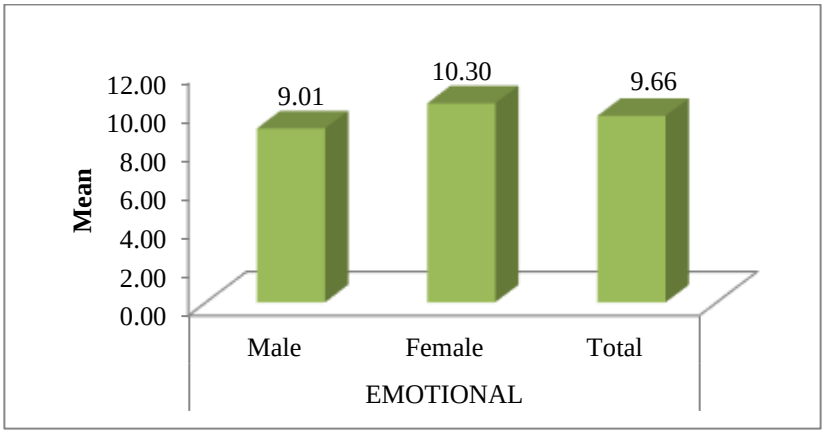

Figure-5: Shows the total mean score of emotional sub-scale for males and females

The figure-5 shows the difference in total mean scores of emotional sub-scale for males and females. The x-axis indicates the males and females and the y-axis indicates the total mean scores for the emotional subscale. In the emotional subscale males were having a total mean score of 9.01 and for females, the total mean score for emotional subscale was 10.30. This result indicates that females are having more emotional problems than males due to reduced tolerance to sounds.

The above results show that both males and females are having the problem in sound intolerance and this intolerance to sounds problem cause them functional, social and emotional problems which may have an impact on their daily life activities. From the results obtained we can say that females are having a high score in each subscale (functional, social and emotional) when compared to males.

Subscale	Gender	N	Mean	SD	Mann Whitney test Z value	P	
Functional	Male	375	11.38	6.36	9.52	.000	HS
	Female	375	15.63	5.86			
	Total	750	13.51	6.47			
Social	Male	375	5.64	4.92	2.54	.011	Sig
	Female	375	6.56	5.01			
	Total	750	6.10	4.98			
Emotional	Male	375	9.01	6.88	2.60	.010	Sig
	Female	375	10.30	6.79			
	Total	750	9.66	6.86			
Total Score	Male	375	25.98	14.78	6.41	.000	HS
	Female	375	32.54	13.22			
	Total	750	29.26	14.39			

Table-3: Indicates mean and the p-value of males and females across each subscale

The table-3 shows the significant difference across the 3 subscales among males and females. Mann Whitney test was used to find out the significant difference across the 3 subscales among males and females. From the table-3 it is clear that there is a significant difference across each

subscale among males and females. The results show that there was a highly significant difference across male and female in the mean scores of functional sub-scale with p-value .000. In the social subscale, the mean scores of males and females were having a significant difference with p-value .011. And in the emotional subscale, there was a significant difference across the mean scores of males and females with p-value .010. There was a highly significant difference between the overall total scores of males and females with p-value .000.

The correlation between the total scores of each subscale was found out using Karl Pearson's coefficient in order to find out whether the intolerance to sound cause more impact on functional, social or emotional aspect.

		Functional	Social	Emotional	Total score
Functional	Pearson Correlation		.402**	.379**	.767**
	P		.000	.000	.000
	N		750	750	750
Social	Pearson Correlation	**		.506**	762**
	P			.000	.000
	N			750	750
Emotional	Pearson Correlation	**	**		.819**
	P				.000
	N				750
Total score	Pearson Correlation	**	**	**	

** Correlation is significant at 0.001

Table-4: Shows the correlation between the functional, social and emotional subscale

The table-4 shows the correlation between the 3 subscales. And from the results, p-value indicates a significant correlation between 3 subscales. The significant correlation between the 3 subscales suggests that there is a significant impact on the functional, social and emotional aspects among youngsters due to intolerance to sounds.

Discussion

Hyperacusis is a condition in which a person has a problem in tolerating sounds that are normal to others. Individuals who are having hyperacusis will be having the problem in tolerating sounds around them. This problem in tolerating sounds that we are exposing to day to day life will have an impact on the quality of life. According to the literature, there are so many factors that can lead to Hyperacusis. One of the most important causative factors that can lead to hyperacusis is noise exposure.

There are studies regarding the hyperacusis among youngsters done in the Western population. In the literature investigation regarding intolerance to sounds report that hyperacusis is seen in all age groups. Nowadays youth are exposed to noise through the use of personal listening devices, listening to music, use of mobile phones etc. so there is a high chance that youngsters are more susceptible to have sound intolerance problems. Anari et al (1999) stated that individuals who

are suffering from hyperacusis are relatively youngsters compared to tinnitus due to exposure to noise. The present research was done to study the intolerance to sounds among youngsters.

The results of the present study show that youngsters are more prevalent to hyperacusis and due to the sound intolerance, they are having functional, social and emotional problems. Short term exposure to sounds through personal listening devices, phones, DJ parties etc. can act as a stress causing factor which can increase the effort required to maintain adequate levels of efficiency on tasks which requires attention, so problems with attention and concentration due to intolerance to sounds can lead to functional problems like difficulty in reading noisy environment, listening in the noisy environment etc. Due to these functional difficulties, individuals with hyperacusis may avoid social activities and this may affect the quality of life of the individual which will result in emotional problems.

Findings of the current study suggest that females were having higher scores in terms of both total scores and the scores of each subscale of functional, social and emotional. A study was conducted in university students of Turkey (Yilmaz, Tas, Bulut, Nurcin, 2017) which support that females are having more problems in tolerating sounds than males. A study by Khalfa et al, 2002 also reported that there a significant difference in the scores of males and females in the emotional and attention domain, but there was no significant difference in the scores of social domain. They also reported that females are more prevalent to hyperacusis than males may be because females express their intolerance to sounds more readily than males.

Hasson, Theorell, Bergquist & Canlon (2013) conducted a study and they reported that acute stress induces hyperacusis in women with a high level of emotional exhaustion. According to them study the possible reason for females to have more intolerance to sounds may be due to the variety of factors like age, estrogen level, the phase of menstrual cycle etc. findings of this study is also correlating with the results of the present study. Intolerance to sounds or hyperacusis can negatively affect someone's day to day life, which can lead to functional, social and emotional problems. The sound intolerance problem is higher in females than in males, females experienced more functional, social and emotional problems than males. As indicated earlier the findings of the present study were similar to other studies in the literature.

Nowadays youngsters are more engaged in activities like listening to music, DJ parties, concerts etc. All these activities make them exposed to different kinds of noise and these may be hazardous to hearing. Because of the noise exposure in youngsters, they are at risk of having sound tolerance problem. Most of them will not be aware of the hazardous effect of noise exposure. So the current research was done to study the sound intolerance problems in the youngsters. Gaining information regarding the sound sensitivity may help to give awareness regarding the noise sensitivity and its effects on hearing. In the current study almost all the participants were reported to have hyperacusis. Only 8% of the participants were reported to have normal sound tolerance. Among the participants who were having hyperacusis most of them were having mild hyperacusis. Number of females who reported to have intolerance to sounds was more compared to males and scores of females were also high. All these findings of the current study imply that sound intolerance is one the problem that is experienced by the young population and it is more common in females than males.

Summary and Conclusion

The aim of the present study was to study the hyperacusis among youngsters and to find out the gender difference in tolerating sounds. Since the perception of sound is a subjective phenomenon a questionnaire was used to study the hyperacusis.

A total number of 750 students (375 males and 375 females) from 5 different colleges of Ernakulum district were randomly selected for the current study. All the subjects participated were native Malayalam speakers. The subjects were provided with the questionnaire, which was translated into Malayalam and was validated by Audiologists. The questionnaire included 20 questions. And the subjects were provided with the translated questionnaire and were asked to mark their response in a 3-point rating scale. Each participant was scored according to their responses and severity of hyperacusis was found out.

The results revealed that most of the youngsters participated in the study was having sound intolerance problem, and due to the sound intolerance, they were reported to have functional, social and emotional problems. The results also indicated that females were having higher scores hence having more problems in tolerating sounds than males. From the results obtained from the present study, we can conclude that youngsters are more vulnerable to have intolerance to sounds or hyperacusis. From the responses of each subject participated in the study it is clear that due to the sound intolerance problem they are facing problems in tolerating sounds compared to normal. Most of the participants reported to have problems like concentrating in the noisy environment, the problem in reading noisy environment, difficulty understanding noisy situation etc., and all these problems restrict them from social participation which may affect their quality of life hence causing emotional problems. So, it is very important to make the youngsters aware of sound intolerance problems and possible causes for hyperacusis like the use of personal listening devices, exposing to high intense sounds such as DJs and concerts etc. Making youngsters aware of hyperacusis may help them to take persuasions like hearing protection devices when they are in a noisy environment. Hearing protection measures will help to protect their hearing from noise hence by reducing the chance of having hyperacusis.

The implication of the study

The present study emphasizes the noise exposure and intolerance to sounds among youngsters and its effects on quality of life. And the study also gives importance in giving awareness among youngsters regarding the hyperacusis.

***The future directions*:**

1. The study can be conducted in other age groups and comparison between the age groups can be done.
2. The study can be done in subjects from different places based on the noise exposure.

==========

References

Anari, M., Axelsson, A., Eliasson, A., & Magnusson, L. (1999). Hypersensitivity to sound - questionnaire data, audiometry and classification. *Scandinavian Audiology journal. 28* (4), 219-230. doi:30.10.1080/010503999424653

Andersson, G., Lindvall, N., Hursti, T. & Carlbring, P. (2002). Hypersensitivity to sound (hyperacusis): A prevalence study conducted via the Internet and post. *International Journal of Audiology*, 41, 545–54. Retrieved from: https://www.ncbi.nlm.nih.gov/pubmed/12477175

Baguley, D., M. (2003). Hyperacusis. *Journal of the royal society of medicine. 96* (12) 582-535. Retrieved from: http://europepmc.org/articles/pmc539655

Beach, E., Williams,W., & Gilliver, M. (2013). Estimating young Australian adults' risk of hearing damage from selected leisure activities. *Ear Hear.* 34, 75-82. doi:10.1097/AUD.0b013e318262ac6c

Brandy, W., T. & Lynn, J., M. (1995). Audiologic findings in hyperacusic and non-hyperacusic Subjects. *American journal of audiology*. *4* (1) doi: 1059-0889/95/0401-0046

Beutel, M., E., Junger, C., Klein, E., M., Wild, P., Lackner, K., Blettner, M., Munzel, T. (2016). Noise Annoyance Is Associated with Depression and Anxiety in the General Population- The Contribution of Aircraft Noise. *PLoS ONE 11*(5): e0155357. Retrieved from: https://doi.org/10.1371/journal.pone.0155357

Blomberg, S., Rosander, M., Andersson, G. (2006). Fears, hyperacusis and musicality in Williams syndrome. *research in developmental disabilities. 27* (6), 668-80. doi:10.1016/j.ridd.2005.09.002

Chung, J. H., Des Roches,C. M., Meunier,. J, Eavey, R. D. (2005). Evaluation of noise-induced hearing loss in young people using a web-based survey technique. *Pediatrics*. *115*(4):861-7. doi: 10.1542/peds.2004-0173

Clark, W. W. (1998). Noise exposure from leisure activities: A review. *The Journal of the Acoustical Society of America. 90* (1) doi:10.1121/1.401285

Coelho, C. B., Sanchez, T. G., Tyler, R. S. (2007). Hyperacusis, sound annoyance, and loudness hypersensitivity in children. *Progress in brain research*. 166, 169-178. Retrieved from: https://doi.org/10.1016/S0079-6123(07)66015-4

Cox, R. M. (1981). Using ULCL measures to find frequency/gain and SSPL 90. *Hearing Instruments, 34* (7). Retrieved from: http://www.harlmemphis.org/files/5414/0442/1899/Using_ULCL_Measures_to_find_Frequency_Gain_and_SSPL90.pdf.

Dauman, R. & Bouscau-Faure, F. (2005). Assessment and amelioration of hyperacusis in tinnitus patients. *Acta oto-larygologia. 125* (5), 503-9. Retrieved from: https://www.ncbi.nlm.nih.gov/pubmed/16092541.

Fabijanska, A., Rogowski, M., Bartnik, G., Skarzyński, H. (1999). Epidemiology of tinnitus and is in Poland. *Proceedings of the 6th International Tinnitus Seminar*. 569–571. Retrieved from: http://www.tinnitus.org/Proceedings%20ITS99.pdf

Gilles, A., De, R.,D., Van, H.,G., Wouters, K., Kleine, P., A. & Van, H., P. (2012). Prevalence of leisure noise-induced tinnitus and the attitude toward noise in university students. *Otology and neurology. 33* (6), 899-906. doi: 10.1097/MAO.0b013e31825d640a.

Gilles, A., Schlee, W., Rabau, S., Wouters, K., Fransen, E. &Van de Heyning, P. (2016).Decreased Speech-In-Noise Understanding in Young Adults with Tinnitus. *Frontiers Neuroscience. 10* (288). doi: 10.3389/fnins.2016.00288

Goodson, S. & Hull, R., H. (2015). Hyperacusis. American Speech and Hearing Association. Retrieved from: https://www.asha.org/uploadedFiles/AIS-Hyperacusis.pdf

Gothelf, D., Farber, N., Raveh, E., Apter A., & Attias, J. (2006).Hyperacusis in Williams syndrome: characteristics and associated neurological abnormalities. *Neurology, 66*, 390-395.doi:10.1212/01.wnl.0000196643.35395.5f.

Gu, J.W., Halpin, C. F., Nam, E. C., Levine, R. A., Melcher, J.R. (2010). Tinnitus, diminished sound-level tolerance, and elevated auditory activity in humans with clinically normal hearing sensitivity. *Journal of neurophysiology. 104* (6), 3361-70. doi:10.1152/jn.00226.2010

Guimaraes, A. C., Carvalho, G. M., Voltolini, M. M., Zappelini, C. E., Mezzalira, R. & Stoler, G. (2014). Study of the relationship between the degree of tinnitus annoyance and the presence of hyperacusis. *Brazilian journal of otorhinolaryngology 80* (1), 24. doi:10.5935/1808-8694.20140007

Hasson, D., Theorell, T., Bergquist, J., & Canlon, B. (2013). Acute stress induces hyperacusis in women with high levels of emotional exhaustion. *8* (1). doi:10.1371/journal.pone.0052945.

Hellstrom, P. A., Axelsson, A., Costa, O. (1998). Temporary threshold shift induced by music. *Scandinavian audiology.supplymentum.* 48, 87-94. Retrieved from: https://www.ncbi.nlm.nih.gov/pubmed/9505301

Jastreboff, P. J. & Hazell, J. W. (2004). neurophysiological approach to tinnitus: clinical implications. *British journal of audiology, 27* (1), 7-17. doi:10.3109/03005369309077884

Jastreboff, M. M., Jastreboff, P. J. (2001). Hyperacusis. *Audiology online.* Retrieved from: https://www.audiologyonline.com/articles/hyperacusis-1223

Katzenell, U. & Segal, S. (2001). Hyperacusis: review and clinical guidelines. *Otology and neurology,22* (3), 321-327. Retrieved from: https://www.ncbi.nlm.nih.gov/pubmed/11347634

Khalfa, S., Bruneau, N., Roge, B., Georgieff, N., Veuillet, E., Adrien, J. L & Collet, L. (2004). Increased perception of loudness in autism. *Hearing Research, 198* (1-2), 87–92. Retrieved from: https://www.ncbi.nlm.nih.gov/pubmed/15617227

Khalfa, S., Dubal, S., Veuillet, E., Perez-Diaz, F., Jouvent, R. & Collet, L. (2002). Psychometric normalization of a hyperacusis questionnaire. *Journal of Oto-Rhino-Laryngology, Head and Neck Surgery. 64* (6), 436-442. doi:10.1159/000067570

Klein, A. J., Armstrong, B. L., Greer, M. K, Brown, F. R. (1990). Hyperacusis and otitis media in individuals with Williams syndrome. *Journal of Speech and Hearing Disorders. 55* (2), 339-344. Retrieved from: https://www.ncbi.nlm.nih.gov/pubmed/2329796

Lee, G. J., Lim, M.Y., Kuan, A.Y.W., Teo, J. H. W., Tan, H. G., & Low, W. K. (2014). *Singapore medical journal. 55* (2), 72-77.doi:10.11622/smedj.2014018

Nelson, J. J., Chen, K. (2004). The relationship of tinnitus, hyperacusis, and hearing loss. *Ear Nose and Throat Journal. 83* (7), 472-6. Retrieved from: https://www.ncbi.nlm.nih.gov/pubmed/15372918

Phillips, D. P, & Carr, M. M (1998). Disturbances of loudness perception. *Journal of the American Academy of Audiology, 9* (5), 371–379. Retrieved from: https://www.audiology.org/sites/default/files/journal/JAAA_09_05_06.pdf

Schmuziger, N., Patscheke, J. & Probst, R. (2006). Hearing in nonprofessional pop/rock musicians. *Ear Hear. 27* (4), 321-30. Retrieved from: https://www.ncbi.nlm.nih.gov/m/pubmed/16825883/?i=4&from=/18462490/related.

Serra, M. R., Biassoni, E. C., Richter, U., Minoldo, G., Franco, G., Abraham, S., Minoldo, G. & Franco, G. (2005). Recreational noise exposure and its effects on the hearing of adolescents.PartI: An interdisciplinary long-term study.*International Journal of Audiology.* 44, 65–73. doi:10.1080/14992020400030010

Shargorodsky, J., Curhan, S. G., Curhan, G. C. & Eavey, R. (2010). Change in prevalence of hearing loss in US adolescents. *JAMA. 304* (7), 772-8. doi: 10.1001/jama.2010.1124.

Sheldrake, J., Diehl, P.U. &Schaette, R. (2015) Audiometric Characteristics of Hyperacusis Patients. *Noise and Health.19* (87), 73-78. doi:10.3389/fneur.2015.00105

Shepherd, D., Welch, D., Dirks, K. N. & Mathews, R. (2010). Exploring the relationship between noise sensitivity, annoyance and health-related quality of life in a sample of adults exposed to environmental noise. *International journal of environmental research public health.7* (10), 3579-94. doi: 10.3390/ijerph7103580.

Silverman, S. R, Harrison, C. E, & Lane, H. S (1946).Tolerance for pure tones and for speech in normal and hard-of-hearing ears (OSRD Report No. 6303).St. Louis, MO: Central Institute for the Deaf.

Smith, P. A., Davis, A., Ferguson, M., & Lutman, M .E. (2000).The prevalence and type of social noise exposure in young adults in England. *Noise and Health 2* (6), 41–56. Retrieved from: http://www.noiseandheath.org/text.asp?2000/2/6/41/32650

Smith, A., Stansfeld, S. (1986). Aircraft Noise Exposure, Noise Sensitivity, and Everyday Errors. *Sage journals*. Retrieved from: sagepub.com/doi/abs/10.1177/0013916586182004.

Soames, J. R. F. (1999). Noise sensitivity as a factor influencing reaction to noise. *Noise and health*. 1, 57-68. Retrieved from: http://www.noiseandhealth.org/text.asp?1999/1/3/57/31713.

Stansfeld, S. A. (1992) Noise, noise sensitivity and psychiatric disorder: Epidemiological and psychophysiological studies**.** *Literature Review in Psychological Medicine 22* (1), 44. doi:10.1017/S0264180100001119 ·

Tyler, R.S., Pienkowski, M., Roncancio, E.R., Jun, H.J., Brozoski, T., Dauman, N.,…. & Moore, B. C. J. (2014). A review of hyperacusis and future directions: Part I Definitions and manifestations. *American Journal of Audiology, 23,*402-419.doi:10.1044/2014_AJA-14-0010

Tyler, R. S. & Conrad-Armes, D. (1983). The determination of tinnitus loudness considering the effects of recruitment. *Journal of speech and hearing research. 26* (1), 59-72. Retrieved from: https://www.ncbi.nlm.nih.gov/pubmed/6865383

Vogel, I., Brug, J., Catharina, P. B., Ploeg, V. D., & Raat, H. (2010). Adolescents risky MP3-player listening and its psychosocial correlates. *Health education research*. *2* (26) 254–264, doi:10.1093/her/cyq091. https://doi.org/10.1093/her/cyq091

Von Bekesy, G. (1936). On the thresholds for hearing and for feeling slow sinusoidal changes in air-pressure. *Annals of Physics*, *418* (6), 554–566.doi:10.1002/andp.19364180606

Wallen, M. B., Hasson, D., Theorell, T. & Canlon, B. (2012). The correlation between the hyperacusis questionnaire and uncomfortable loudness levels is dependent on emotional exhaustion. *International journal of audiology,* 51,722-729. doi:10.3109/14992027.2012.695874

Wegel, R. L. (1932). Physical data and physiology of excitation of the auditory nerve. *Annals of Otology, Rhinology, and Laryngology*, *41*(3), 740-779.doi:10.1177/000348943204100306

Widen, S. E.O., Erlandsson, S. I. (2004). Self-reported tinnitus and noise sensitivity among adolescents in Sweden. *Noise and Health*, 7, 29-40. Retrieved from: http://www.noiseandhealth.org/text.asp?2004/7/25/29/31649

Yilmaz, S., Tas, M., Bulut, E. & Nurcin E. (2017). Assessment of Reduced Tolerance to Sound (Hyperacusis) in University Students. *Noise and health*. *19* (87) 73-8. Retrieved from: http://www.noiseandhealth.org/text.asp?2017/19/87/73/204626

Zhao, F., Manchaiah V. K., French, D. & Price, S. M. (2010). Music exposure and hearing disorders: an overview. *International journal of audiology*. *49* (1), 54-64. doi:10.3109/14992020903202520.

==========