

# Gender wise association between diabetes mellitus and hearing loss in western Rajasthan population

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## Abstract

**Background:** Diabetes mellitus is a non-communicable chronic metabolic disorder. The association between sensorineural hearing loss and diabetes has become an important subject of research. Correlation of hearing loss with genders is not still clear so we have aimed our study to explore the same.

**Objective:** To examine the gender-specific association between diabetes and hearing loss.

**Methods:** This study was conducted on a total number of 150 (78 male & 72 female) selected diabetic patients from November 2018 to December 2020. The correlation of hearing loss between male and female diabetic patients was compared by getting a pure tone audiogram.

**Results:** Out of a total of 150 patients, only 42 patients (28%) were suffered from hearing loss. Sensorineural hearing loss was present 25.6% in males and 30.5% in females which was not significantly different ( $p > 0.05$ ).

**Conclusion:** We concluded that hearing loss has no significant association with genders in diabetic patients, but early diagnosis and screening of diabetic patients for hearing loss help in a better quality of life.

**Keywords:** Diabetes, hearing loss, pure tone audiometry

## Introduction

Hearing is very essential for communication and functional ability in humans and when this is impaired, quality of life is significantly affected due to ineffective communication<sup>[1,2]</sup>. According to WHO, 5% population of the world has suffered from hearing loss, and this data increases due to the elderly population<sup>[3]</sup>. Various causes of hearing loss in the population are presbycusis, genetic factors, neurological causes, vascular cause, metabolic disorders, ototoxic drugs, noise trauma and diabetes mellitus<sup>[4-6]</sup>. Diabetes mellitus is a non-communicable chronic metabolic disorder with altered blood glucose levels caused by relative or absolute insulin deficiency associated with long-term vascular and neurological complications<sup>[7]</sup> and affects lipid and protein metabolism.

## Materials and Methods

Our study was conducted on a total number of 150 selected diabetic patients from November 2018 to December 2020 in MDM hospital, Jodhpur (Rajasthan). Ethical approval was obtained from the Ethics and Research committee of S. N. Medical College, Jodhpur. Informed consent was taken from all the participants. All the ENT examinations and audiological evaluations were performed in ENT department of MDM Hospital and patients were referred from medicine department of Dr. S.N. Medical College and associated groups

of hospital. Only biochemically confirmed patients referred from medicine department below 50 years of age who had normal otoscopic examination were included in study. Patients with history of ear disease, ear surgery, history of hearing impairment caused by any other disorder, history of noise exposure and ototoxic drug intake, were excluded from the study. We also excluded non cooperative subjects and subjects which were not able to communicate. Upper age group limit was strictly limited to 50 years to minimize the effect of presbycusis. After complete ear, nose & throat examination, all patients had undergone a hearing assessment by pure tone audiometer [AC 40] in a sound proof room. Pure tone thresholds were measured for at 250, 500, 1000, 2000, 3000 & 4000 Hz for both air and bone conduction & 6000 and 8000 Hz for air conduction only. Before going through procedure subject is examined for the presence of ear wax, fungal plug or any other local pathology.

Average of audiometric hearing threshold at 500, 1000 and 2000 Hz for both air & bone conduction was calculated as pure tone average and categorized normal hearing (<25 dB), mild hearing loss (26-40 dB), moderate hearing loss (41-60 dB), severe hearing loss (61-80 dB) and profound hearing loss (81dB & above) in accordance to the WHO.

Statistical analysis for quantitative data was calculated through mean and standard deviation (S.D.). Proportions and percentage were measured for quantitative data. Chi square test was used for analysis. Significance level was kept 0.05 with the corresponding confidence level 95. P value <0.05 was taken as significant for study. IBM SPSS version 23 software was used for statistical analysis.

## Results

Total 150 patients were participated in our study. Out of that 78 were male (52%) and 72 were female (48%). The male: female ratio was 1:1.08.

The prevalence of hearing loss in study groups was 28% (20 male & 22 female as shown in table 1).

**Table 1:** Prevalence of hearing loss in diabetic patients

Presence of SNHL	Male (n=78)	Female (n=72)	P value
Present	20 (25.6%)	22 (30.5%)	0.505
Not present	58 (74.4%)	50 (69.5%)	

**Note:** SNHL-Sensorineural hearing loss, n= number of subjects.

Table 2 and figure 1 are showing the number of male and female having different degree of hearing loss in diabetic group. In this group 108 subjects including 58 males and 50 females were within normal limit and having no hearing loss. 12 males and 11 females total 23 were mild, 4 male and 5 female total 9 were having moderate, 3 male and 6 females total 9 were moderately severe and only 1 male was having severe degree of hearing loss. There was no correlation found among male and female patients having hearing loss in diabetes so it can be said that hearing loss in diabetes has no association with gender (p value >0.05).

**Table 2:** Gender wise distribution of hearing loss cases in diabetic group

Hearing Loss in diabetic group				
		Gender		Total
		Male	Female	
Degree of Hearing Loss	WTL	58	50	108
	Mild	12	11	23
	Moderate	4	5	9
	Moderately severe	3	6	9
	Severe	1	0	1
Total		78	72	150

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	2.511	4	0.643
Likelihood Ratio	2.914	4	0.572
Linear-by-Linear Association	0.646	1	0.422
N of Valid Cases	150		

Note: WTL=within normal limit, M= Male, F= Female.

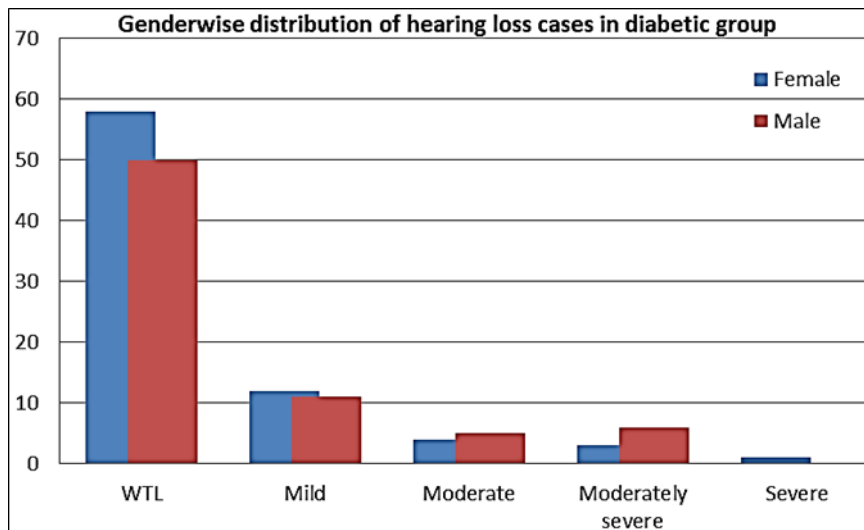


Fig 1

Table 3 is showing descriptive analysis of audiometry of bone conduction and air conduction at different frequencies in diabetic group. It is clearly visible from the table that at high frequencies hearing threshold is more than lower frequencies.

Table 3: Descriptive study of audiometry in diabetic group

Descriptive Statistics of audiometry at different frequencies in Diabetes Group					
Frequency (Hz)	N	Minimum	Maximum	Mean	Std. Deviation
250 AC	150	15	60	25.43	20.952
250 BC	150	5	50	15.93	9.348
500 AC	150	15	75	27.72	40.294
500 BC	150	5	65	16.70	10.295
1000AC	150	15	75	32.91	80.165
1000 BC	150	5	65	18.10	11.552
2000AC	150	15	75	40.81	161.056
2000 BC	150	5	65	19.47	12.413
4000 AC	150	15	75	55.53	323.470

4000 BC	150	10	60	20.20	13.385
8000 (AC only)	150	15	80	30.36	16.054
PTA	150	15	75	26.340	12.385
Valid N (list wise)	150				

Note: N-Number of subjects AC-Air Conduction BC-Bone Conduction, Hz-Hertz, PTA-Pure Tone Average.

Table 4 showing comparison of mean pure tone average (PTA) in affected males and females.

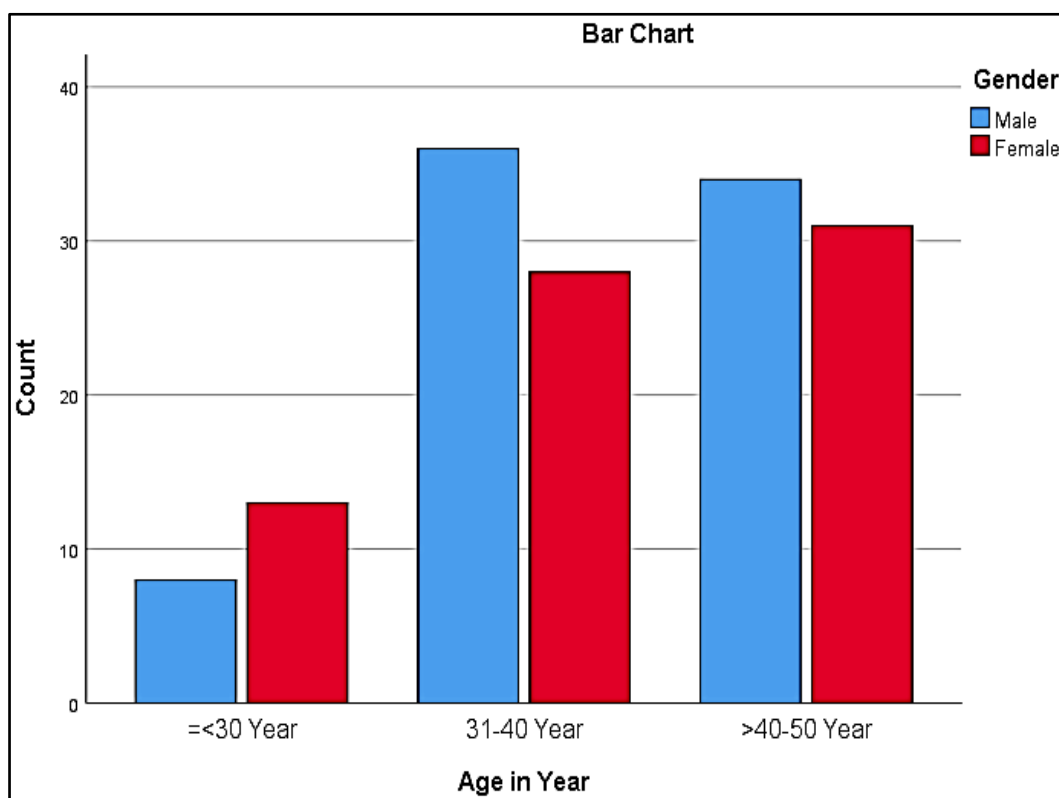
**Table 4:** Gender wise mean PTA comparison in affected patients

S.N.	Male	Female	P value
Mean PTA	25.89±11.91	26.62±12.62	0.848

Table 5 and figure 2 are showing gender wise distribution of subjects in different age group. Maximum patients were found in the 41-50 years age group.

**Table 5:** Gender wise distribution in different age groups in diabetic group

Gender Wise Age Distribution In Diabetic Group				
		Gender		Total
		Male	Female	
Age in Year	≤30 Year	8	13	21
	31-40 Year	36	28	64
	41-50 Year	34	31	65
Total		78	72	150

**Fig 2**

## Discussion

Hearing loss is a major public health problem that affects 5% population and causes functional and occupational losses<sup>[3]</sup>. In our study total of 150 patients were included from 10 to 50 years of age. Above 50 years of age, patients were excluded to minimize the effect of presbycusis. Age-related hearing loss usually increases after the fifth decade but the metabolic disorder may cause earlier presentation. Diabetes affects all systems including vestibular and cochlear systems: unfortunately, the mechanism of affecting the inner ear is not completely resolved<sup>[10-12]</sup>.

In our study, we divided patients according to their sex and compared the results of hearing loss by calculating pure tone audiometry. In the present study, we had 78(52%) male and 72(48%) female patients in the diabetic group and we observed 20(25.64%) males and 22(30.55%) females of all age groups having hearing loss of different degrees and it was not

found significant (*p-value* was more than 0.05) and there was no static difference in pure-tone average in both sexes as shown in table 4 (*p-value* is more than 0.05). So, it was concluded that there is no sex-wise association of hearing loss in diabetic patients (Table 1 & 2)). Our study results were similar with Kakalapudi V *et al.*, Rajendran S. *et al.*, Saini S *et al.*, Meena R *et al.*, Chamyal 1997 and Sharma *et al.*, 1999<sup>[11, 13-18]</sup>. Some study denies this relationship and contrary to our study Taylor *et al* and Wang *et al* reported that diabetic female patients have a higher incidence of hearing loss in comparison to males<sup>[19, 20]</sup>.

In our study, hearing loss was more for higher frequency and sensorineural type (Table 3) which are comparable to other studies<sup>[11-18]</sup>.

Maximum numbers of the diabetic patient were found 41-50 years group of age. In our study only 21(14%) patients with diabetes were found in the group  $\leq 30$  years, age group 31-40 years group had 64(42.67%) and 41-50 years age group had 65(43.33%). So, with these results, it can be easily concluded that increasing age has a positive correlation with diabetes mellitus (Table 5). Chamyal 1997 and Sharma *et al* 1999 also observed the same results in their studies although Chamyal had lesser patients in 31-40 years in comparison to  $\leq 30$ -year group<sup>[13, 14]</sup>.

### Summary & Conclusion

In the present study, we concluded that there is no sex-wise association between diabetes mellitus and hearing loss. In diabetes, hearing loss was found of sensorineural type and higher frequency was most affected. It was the major finding in our study that hearing loss in DM was found maximum in 41-50 years age group so increasing age is a risk factor in diabetics for hearing loss.

On the basis of our study, we recommend all diabetic patients for regular screening of hearing for both sexes. This early diagnosis and proper treatment and care can improve the condition and can give a better quality of life.

Studies on sex-specific association between hearing loss and diabetes have not much been explored in the western Rajasthan population. Our study aimed an effort for the diabetes patients suffering from hearing loss in the Jodhpur district of western Rajasthan.

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