International Journal of Medical and Pharmaceutical Research

Online ISSN-2958-3683 | Print ISSN-2958-3675
Frequency: Bi-Monthly
Available online on: https://ijmpr.in/

Original Article

Audio Logical Profile of Diabetic Associated Hearing Loss

Dr. Abhishek Vyas,[1] Dr. Monika Ranga[2]
[1]Senior Resident, Department of ENT, SPMC Bikaner
[2]Assistant Professor, Department of Obstetrics and Gynaecology, SPMC Bikaner.

OPEN ACCESS

Corresponding Author:

Dr. Monika Rang
Assistant Professor, Department of Obstetrics and Gynaecology, SPMC Bikaner.
Email:
rangamonika.mr@gmail.com

Received: 20-12-2025
Accepted: 13-01-2026
Published: 25-01-2026

ABSTRACT

INTRODUCTION: Diabetes mellitus (DM) is a chronic metabolic disorder characterized by persistent hyperglycemia resulting from defects in insulin secretion, insulin action, or both, and it is associated with a wide range of metabolic, neurological, and vascular complications. **AIM:** The aim of this study is to evaluate the audiological profile of hearing loss associated with diabetes mellitus. **METHODOLOGY:** This hospital-based cross-sectional observational study was conducted in the Department of Otorhinolaryngology at spmc Bikaner, from jan 2023 during routine outpatient hours. **RESULT:** The study revealed a predominance of bilateral, high-frequency sensorineural hearing loss among diabetic patients, with outer hair cell dysfunction evident on DPOAE testing. Increasing duration of diabetes and poorer glycemic control were associated with greater severity of hearing impairment. **CONCLUSION:** Type 2 diabetes mellitus is significantly associated with bilateral, high-frequency sensorineural hearing loss, reflecting systemic metabolic involvement of the auditory system. Poor glycemic control and longer disease duration contribute to greater severity of hearing impairment, underscoring the need for regular audiological screening in diabetic patients.

Keywords: Diabetes mellitus, DPOAE, hyperglycemia.

INTRODUCTION

Diabetes mellitus (DM) is a chronic metabolic disorder characterized by persistent hyperglycemia resulting from defects in insulin secretion, insulin action, or both, and it is associated with a wide range of metabolic, neurological, and vascular complications[1]. Globally, diabetes has emerged as a major public health concern, with current estimates indicating that approximately one in every eleven individuals is affected worldwide. Among countries with a high burden of disease, Brazil ranks fourth in terms of the number of individuals aged 20–79 years living with diabetes, accounting for nearly 14.3 million cases.[2] Type 2 diabetes mellitus constitutes the most prevalent form of the disease, representing about 90% of all diagnosed cases, and predominantly affects middle-aged and elderly populations. Individuals with diabetes are at an increased risk of developing chronic complications due to prolonged exposure to elevated blood glucose levels, which can adversely affect multiple organ systems, including the cardiovascular system, eyes, kidneys, and peripheral nerves.[3] In addition to these well-recognized complications, increasing evidence suggests that diabetes can also have detrimental effects on the auditory system. Several studies have reported structural and functional changes within the inner ear of diabetic individuals, including thickening of the basement membrane of capillaries in the stria vascularis and basilar membrane, changes that are characteristic of diabetic microangiopathy.[4] Such microvascular alterations are believed to compromise the supply of oxygen and essential nutrients to the cochlea, thereby impairing its normal function. The proposed pathophysiological mechanisms include both direct and indirect effects of microangiopathy, wherein thickening of capillary walls reduces molecular transport, while vascular narrowing diminishes blood flow, ultimately leading to cellular damage and loss of biological tissue[5]. Beyond cochlear involvement, diabetes may also cause secondary degeneration of the eighth cranial nerve, resulting in neural components of hearing impairment. The association between diabetes mellitus and hearing alterations has been highlighted in multiple clinical and experimental studies, many of which have demonstrated elevated audiometric thresholds and altered otoacoustic emission responses in diabetic patients compared to non-diabetic controls. Furthermore, diabetes has been identified as a risk factor for the development of sudden sensorineural hearing loss, suggesting an acute as well as chronic impact on auditory function[6]. Despite growing recognition of this association, hearing loss remains an underappreciated complication of diabetes. [7]

AIM

The aim of this study is to evaluate the audiological profile of hearing loss associated with diabetes mellitus.

METHODOLOGY

This hospital-based cross-sectional observational study was conducted in the Department of Otorhinolaryngology at spmc Bikaner, from jan 2023 during routine outpatient hours. Ethical approval was obtained prior to the study, and informed written consent was taken from all participants. A total of 76 patients with a confirmed diagnosis of diabetes mellitus attending the ENT and Medicine outpatient departments were enrolled. Detailed clinical history including age, sex, duration of diabetes.. All patients underwent thorough general, systemic, and otorhinolaryngological examination. Audiological evaluation was performed using pure tone audiometry in a sound-treated room with a calibrated audiometer. Air and bone conduction thresholds were assessed at standard frequencies, and hearing loss was classified according to degree and type. Inclusion criteria comprised diabetic patients aged 20–70 years with a duration of diabetes of more than one year and willingness to participate in the study. Patients with no prior history of hearing loss before the diagnosis of diabetes were included. Exclusion criteria included patients with chronic otitis media, otosclerosis, previous ear surgery, head injury, or congenital hearing loss. Patients with a history of significant noise exposure or intake of ototoxic drugs were excluded. Individuals with systemic or neurological disorders known to affect hearing were also excluded to minimize confounding factors.

RESULTS

Table 1: Age and Gender Distribution of Study Participants

Age group	Male	Female
20–30	3	2
31–40	6	5
41–50	12	15
51–60	9	14
61–70	4	6

The study population showed a progressive increase in participants from the 20–30 to the 41–50 age group, with the highest representation seen in the 41–50 years category. Females outnumbered males in the older age groups (41–70 years), while males were slightly more prevalent in the younger age groups.

Table 2: Duration of Diabetes Mellitus

Duration of Diabetes	Number of Patients	Percentage (%)
1–5 years	24	31.6%
6–10 years	28	36.8%
11–15 years	16	21.1%
>15 years	8	10.5%

Most patients had a duration of diabetes between 6–10 years (36.8%), followed by those with 1–5 years of disease (31.6%). A smaller proportion had longer disease duration, with 21.1% having diabetes for 11–15 years and only 10.5% for more than 15 years.

Table 3: Prevalence of Hearing Loss in Diabetic Patients

Hearing Status	Number of Patients	Percentage (%)
Normal hearing	28	36.8%
Conductive hearing loss	4	5.3%
Sensorineural hearing loss	38	50%
Mixed hearing loss	6	7.9%

Half of the study population exhibited sensorineural hearing loss (50%), making it the most common hearing status observed. Normal hearing was present in 36.8% of participants, while conductive (5.3%) and mixed hearing loss (7.9%) were comparatively less frequent.

Table 4: Otologic symptoms

Otologic symptoms:	Number of Patients	Percentage (%)
Otalgia (earache)	6	7.9%
Dizziness	14	18.4%
Tinnitus: High frequency	22	28.9%
No otologic symptoms	34	44.8%

Nearly half of the participants (44.8%) reported no otologic symptoms. Among symptomatic individuals, high-frequency tinnitus was the most common complaint (28.9%), followed by dizziness (18.4%) and otalgia (7.9%).

Table 5: Degree of Hearing Loss (Based on PTA)

Degree of Hearing Loss	Number of Patients	Percentage (%)
Mild (26–40 dB)	17	22.3%
Moderate (41–55 dB)	14	18.4%
Moderately severe (56–70 dB)	9	11.8%
Severe (71–90 dB)	5	6.5%
Profound (>90 dB)	3	3.9%

Mild hearing loss (26–40 dB) was the most common degree observed, accounting for 22.3% of cases, followed by moderate loss (18.4%). Moderately severe (11.8%), severe (6.5%), and profound hearing loss (3.9%) were progressively less frequent.

Table 6: Laterality of Hearing Loss

Laterality	Number of Patients	Percentage (%)
Unilateral	16	21.05%
Bilateral	32	42.1%

Bilateral hearing loss was more common, observed in 42.1% of participants. Unilateral involvement was seen in 21.05% of cases, indicating a clear predominance of bilateral affection.

Table 7: Distribution of Study Participants According to Glycemic Control (HbA1c Levels)

Control of diabetes	Number of Patients	Percentage (%)
<6.5%[good control]	29	38.1%
6.6-7.9%[fairly good control]	32	42.1%
>8%[poor control]	15	79.7%

Most patients had fairly good glycemic control (HbA1c 6.6–7.9%), accounting for 42.1%, followed by good control (<6.5%) in 38.1% of cases. A smaller proportion of patients had poor glycemic control (HbA1c >8%).

Table 8: Association Between Duration of Diabetes and Severity of Hearing Loss

Control on diabetes	Mild	Moderate-modertae	Severe-profound

		severe	
<6.5%[good control]	9	4	0
6.6-7.9%[fairly good control]	6	12	2
>8%[poor control]	2	7	6

Patients with good glycemic control (<6.5%) predominantly had mild hearing loss, with no cases of severe–profound loss observed. In contrast, poorer glycemic control was associated with increasing severity of hearing loss, with the highest number of severe–profound cases seen in patients with HbA1c >8%.

Table 9: Audiometric Configuration in Diabetic Patients

Audiogram Pattern	Number of Patients	Percentage (%)
High-frequency loss	26	54.1%
Flat loss	12	25%
Rising	6	12.5%
Sloping loss	4	8.3%

High-frequency hearing loss was the most common audiogram pattern, observed in 54.1% of patients. Flat (25%), rising (12.5%), and sloping (8.3%) patterns were less frequently noted.

Table 10: Distortion Product Otoacoustic Emissions (DPOAE) Findings

DPOAE Finding	Number of Patients	Percentage (%)
Present at all frequencies (normal outer hair cell function)	18	37.5%
Absent at high frequencies	26	54.1%
Reduced amplitude at high frequencies	4	8.4%
Completely absent	0	0

More than half of the patients showed absent DPOAE responses at high frequencies (54.1%), indicating outer hair cell dysfunction predominantly in the basal cochlea. Normal DPOAE responses at all frequencies were observed in 37.5% of participants, while 8.4% showed reduced high-frequency amplitudes and none had completely absent responses.

DISCUSSION

Our study showed a gradual increase in both male and female participants with advancing age, peaking in the 41–50 and 51–60 year age groups. Females outnumbered males in most age categories, particularly between 41–50 and 51–60 years. The lowest representation was seen in the 20–30 year age group for both sexes. Middle-aged adults (41–60 years) constituted the majority of the study sample. Chavan RP et al[8] study was done on 137 diabetic participants who attended ENT OPD during the study period.In the study, 75.9% participants were between 41- and 50- year age-group as given in Table 1. The mean age of study group was 46.06 ±5.353. Among the 137 diabetic participants in the study, 83 (60.58%) were females and 54 (39.42%) were males.

In our study patients had a duration of diabetes between 6–10 years, accounting for the largest proportion (36.8%) of the study population. This was followed by those with a disease duration of 1–5 years (31.6%), indicating that a substantial number were relatively early in the course of diabetes. Patients with 11–15 years of diabetes constituted 21.1% of the group. A smaller proportion of patients (10.5%) had diabetes for more than 15 years.

In the present study Out of the total participants, normal hearing was observed in 36.8% of cases.Sensorineural hearing loss was the most common finding, affecting half of the study population (50%).Mixed hearing loss was identified in 7.9% of patients.Conductive hearing loss was relatively uncommon, seen in only 5.3% of cases.Nkosi S, et al[9] This study revealed a 31.4% prevalence of hearing loss with 81.8% being sensorineural in nature.

In the present study Otologic symptoms were absent in a substantial proportion of participants, with 44.8% reporting no ear-related complaints. Among symptomatic individuals, high-frequency tinnitus was the most common symptom, observed in 28.9% of cases. Dizziness was reported by 18.4% of participants, indicating possible vestibular involvement. Otalgia was relatively uncommon, seen in only 7.9% of the study population.

In our study Most participants had mild hearing loss (22.3%), making it the most frequently observed degree of impairment.Moderate hearing loss was seen in 18.4% of cases, followed by moderately severe loss in 11.8%.Severe hearing loss accounted for 6.5% of the study population.Only a small proportion exhibited profound hearing loss (3.9%).Kim et al[10] showed According to WHO criteria, the T2DM group exhibited 22.1% mild (26-40 dB), 25.5% moderate (41-60 dB), 8.5% severe (61-80 dB), and 1.7% profound (>80 dB) hearing loss all with statistically significant differences compared controls ($p \leq .0001$).

In our study Hearing loss was more commonly bilateral, affecting 42.1% of the study participants.Unilateral hearing loss was observed in 21.05% of cases.This indicates a greater tendency toward involvement of both ears rather than a single ear.Bilateral involvement suggests a systemic or metabolic influence on auditory function.Kim et al[10] In the T2DM group, data on laterality showed 15.0% unilateral and 29.6% bilateral hearing loss, both significantly higher than the controls ($p = .008$, $p < .0001$).

In our study, good glycemic control (HbA1c <6.5%) was observed in 38.1% of patients, while the largest proportion (42.1%) had fairly good control with HbA1c levels between 6.6–7.9%. A smaller subset of patients showed poor glycemic control with HbA1c levels >8%. In contrast, Sachdeva et al[11]. reported a higher burden of uncontrolled diabetes, with 19 out of 31 patients (61%) having HbA1c levels >8.5%. This comparison suggests relatively better glycemic control among patients in the present study.

In our study Patients with good glycemic control (HbA1c <6.5%) predominantly had mild hearing loss, with no cases of severe-to-profound loss observed in this group. Those with fairly good control (HbA1c 6.6–7.9%) showed a higher proportion of moderate to moderately severe hearing loss, along with a few cases of severe-to-profound loss. In contrast, patients with poor glycemic control (HbA1c >8%) demonstrated a marked shift toward greater severity of hearing impairment. Severe-to-profound hearing loss was most frequent in the poorly controlled group. This, worsening glycemic control was associated with increasing severity of hearing loss.

In our study High-frequency hearing loss was the most common audiogram pattern, observed in 54.1% of patients. Flat loss was the next most frequent pattern, accounting for 25% of cases. Rising audiogram configuration was seen in 12.5% of participants. Sloping loss was comparatively uncommon, present in only 8.3% of patients.

In our study Distortion Product Otoacoustic Emissions were normal at all tested frequencies in 37.5% of patients, indicating preserved outer hair cell function. Absent DPOAE responses at high frequencies were the most common finding, observed in 54.1% of participants. Reduced DPOAE amplitudes at high frequencies were seen in 8.4% of cases. No patient showed complete absence of DPOAE responses across all frequencies. Overall, the findings suggest predominant high-frequency outer hair cell dysfunction.Munjal et al[12] study showed, only 3.3% of subjects exhibited OAE. With an increase in glycosylated hemoglobin ($P = 0.001$), the distortion product OAE (DPOAE) amplitude decreased. The majority, i.e., 12 (41.3%) had reduced amplitude of DPOAE at 6 kHz, followed by 9 (31.2%) at 4 kHz, 5 (17.2%) at 2 kHz, and 3 (10.3%) at 8 kHz.

CONCLUSION

The present study demonstrates a clear association between type 2 diabetes mellitus and auditory dysfunction, with middle-aged females forming the majority of the affected population. Sensorineural hearing loss, predominantly bilateral and involving high frequencies, was the most common audiological finding, suggesting a systemic metabolic influence on cochlear function. Poor glycemic control and longer duration of diabetes were associated with increasing severity of hearing loss, highlighting the role of chronic hyperglycemia in auditory damage. DPOAE findings further supported early outer hair cell dysfunction, particularly at high frequencies, even in patients with relatively preserved hearing thresholds. These results emphasize the importance of routine audiological screening and strict glycemic control in diabetic patients for early detection and prevention of progressive hearing impairment.

REFERENCES

1. Adebola, S.O., Olamoyegun, M.A., Sogebi, O.A., Iwuala, S.O., Babarinde, J.A., & Oyelakin, A.O. (2016). Otologic and audiologic characteristics of type 2 diabetics in a tertiary health institution in Nigeria. Brazilian Journal of Otorhinolaryngology, 82(5), 567–573. 10.1016/j.bjorl.2015.10.016 [DOI] [PMC free article] [PubMed] [Google Scholar]
2. Aggarwal, R., & Ranganathan, P. (2019). Study designs: Part 2 – Descriptive studies. Perspectives in Clinical Research, 10(1), 34–36. 10.4103/picr.PICR_154_18 [DOI] [PMC free article] [PubMed] [Google Scholar]
3. Agrawal, Y., Carey, J.P., Della Santina, C.C., Schubert, M.C., & Minor, L.B. (2009). Disorders of balance and vestibular function in US adults: Data from the National Health and Nutrition Examination Survey, 2001–2004. Archives of Internal Medicine, 169(10), 938–944. 10.1001/archinternmed.2009.66 [DOI] [PubMed] [Google Scholar]

4. Akinpelu, O.V., Mujica-Mota, M., & Daniel, S.J. (2014). Is type 2 diabetes mellitus associated with alterations in hearing? A systematic review and meta-analysis. The Laryngoscope, 124(3), 767–776. 10.1002/lary.24354 [DOI] [PubMed] [Google Scholar]
5. Al-Rubeaan, K., AlMomani, M., AlGethami, A.K., Darandari, J., Alsalhi, A., AlNaqeeb, D., Almogbel, E., Almasaari, F.H., & Youssef, A.M. (2021). Hearing loss among patients with type 2 diabetes mellitus: A cross-sectional study. Annals of Saudi Medicine, 41(3), 171–178. 10.5144/0256-4947.2021.171 [DOI] [PMC free article] [PubMed] [Google Scholar]
6. Alshuaib, W.B., Al-Kandari, J.M., & Hasan, S.M. (2015). Classification of hearing loss. Update On Hearing Loss, 4, 29–37. 10.5772/61835 [DOI] [Google Scholar]
7. Anastasio, A.R., Radael, R.D., Cavalcante, J.M., & Hatzopoulos, S. (2012). A report of extended high frequency audiometry thresholds in school-age children with no hearing complaints. Audiology Research, 2(1), e8. 10.4081/audiores.2011.e8 [DOI] [PMC free article] [PubMed] [Google Scholar]
8. Chavan RP, Nazir HA, Ingole SM, et al. Hearing Assessment in Adult Diabetic Participants by Pure Tone Audiometry: At Tertiary Hospital in India. Int J Otorhinolaryngol Clin 2024;16(2):117–123.
9. Nkosi S, Peter V, Paken J. Audiological profile of patients with type 2 diabetes mellitus. S Afr J Commun Disord. 2024 Jul 31;71(1):e1-e13. doi: 10.4102/sajcd.v71i1.1035. PMID: 39099284; PMCID: PMC11304386.
10. Kim, C.H.-s., Lauritsen, K.L., Nguyen, S.A., Meyer, T.A., Cumpston, E.C., Pelic, J. and Labadie, R. (2025), Characteristics of Hearing Loss in Type 2 Diabetes Mellitus: A Systematic Review and Meta-Analysis. Otolaryngol Head Neck Surg, 173: 1317-1327. https://doi.org/10.1002/ohn.1378,
11. Sachdeva, K., & Azim, S. (2018). Sensorineural hearing loss and type II diabetes mellitus. International Journal of Otorhinolaryngology and Head and Neck Surgery, 4(2), 499–507. https://doi.org/10.18203/issn.2454-5929.ijohns20180714.
12. Munjal, M., Mittal, N., Munjal, S., Kaur, H., Arora, V., Randev, A., Jeriwal, S., Budhiraja, P., Mehta, D., & Pillai, A. (2025). Demographic profile of diabetic subjects with hearing loss in a tertiary health care facility of Punjab. International Journal Of Community Medicine And Public Health, 12(6), 2592–2596. https://doi.org/10.18203/2394-6040.ijcmph20251698.