

Attitude and Awareness Among Adults of Different Age Groups Regarding Diabetes Mellitus Related Hearing Loss in Rural Areas of Trivandrum District in Kerala

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Abstract

Diabetes mellitus (DM) is a chronic metabolic disorder linked to microvascular and neuropathic complications, yet DM-related hearing loss (HL) remains frequently under-recognized. This cross-sectional study assessed and compared the attitude and awareness regarding this complication among 90 adults (equally distributed into age groups: 18–35, 36–54, and 54+ years) in rural Trivandrum, Kerala, using a validated 18-item Malayalam questionnaire. The results revealed poor overall awareness: only 51.1% of participants had heard of the condition, and only 33.3% recognized DM as a cause of auditory impairment. Significant age-related differences emerged; while older adults (54+ years) demonstrated better recognition of functional conversational and telephone difficulties, they lacked awareness regarding early indicators like high-frequency HL and tinnitus. Notably, all older participants recognized the preventive value of a healthy lifestyle. These widespread deficiencies highlight a critical need for targeted public health strategies, where audiologists must play a leading role. Audiologists are essential in designing culturally appropriate community education programmes, establishing interdisciplinary partnerships with primary diabetes care providers, and integrating routine audiological screenings into standard diabetic health services. Through these proactive initiatives, audiologists can facilitate early detection, timely management, and better long-term hearing health outcomes in rural diabetic populations.

Keywords: Diabetes Mellitus, Hearing Loss, Awareness, Attitude, Rural Healthcare, Trivandrum, Kerala, Audiological Rehabilitation

Introduction

DM is a chronic metabolic disorder of global significance, characterized by persistent hyperglycaemia resulting from defects in insulin secretion, insulin action, or both. Over the past few decades, DM has emerged as one of the most pressing public health challenges worldwide, particularly in low- and middle-income countries such as India. Beyond its well-established complications—retinopathy, nephropathy,

neuropathy, and cardiovascular disease—growing evidence has identified HL as a significant yet under-recognized complication of DM. Sensorineural hearing loss (SNHL), the most prevalent type associated with DM, results from microvascular damage to the cochlea, oxidative stress, and peripheral neuropathy affecting the auditory pathway. Despite this documented association, hearing health continues to be overlooked in routine diabetic care, particularly in rural settings.

HL is among the most common sensory disabilities globally, affecting over 1.5 billion people, with a disproportionate burden borne by older adults and populations in low-resource settings (World Health Organization [WHO], 2021). In India, community-based studies have reported HL prevalence ranging from 6% to 26.9%, with rural and elderly populations being most affected. Individuals with DM are estimated to have nearly twice the risk of developing HL compared to those without the condition (Bainbridge et al., 2008). Studies conducted in India have further reported a high prevalence of SNHL among diabetic patients—often exceeding 60%—with severity escalating with age, duration of disease, and poor glycaemic control (Deepthi & Kasthuri, 2012).

Awareness and attitudes are two critical behavioural determinants that influence the timely recognition and management of diabetes-related complications. Awareness encompasses an individual's knowledge about the relationship between DM and HL, while attitude reflects their beliefs, perceptions, and readiness to engage in preventive health behaviours. Variations in these factors across age groups—young adults (18–35 years), middle-aged adults (36–54 years), and older adults (55 years and above)—may significantly affect health-seeking behaviour, adherence to screening, and uptake of rehabilitative services (Rosenstock, 1974). Younger individuals may underestimate their long-term risk due to a sense of invulnerability, while older adults, despite higher susceptibility, may face structural barriers such as financial constraints and limited mobility.

The rural areas of Trivandrum district in Kerala present a particularly relevant setting for such an inquiry. Although Kerala is nationally recognized for its comparatively high health indices and literacy rates, disparities between urban and rural communities persist. Audiological services, public health education on hearing health, and systematic screening for DM-related HL remain limited in rural regions. Furthermore, community awareness about HL as a complication of diabetes is likely insufficient, as public health campaigns tend to focus on more visible complications such as vision impairment and kidney failure (Government of Kerala, 2020). Assessing the attitudes and awareness of adults in these communities—across different age groups—is therefore essential for identifying knowledge gaps and designing targeted, age-sensitive health communication and intervention strategies. The findings of such a study can inform audiologists, public health practitioners, and policymakers in developing community-based screening programmes and educational initiatives to mitigate the burden of diabetes-related HL in rural populations.

Review of Literature

The review of literature examines existing research on the association between DM and HL, the mechanisms underlying this relationship, and studies exploring awareness and attitudes towards diabetic complications across populations. The literature has been organized under Western studies and Indian studies to provide a comprehensive understanding of the global and local evidence base.

Western literature

Bainbridge et al. (2008) conducted a landmark analysis using data from the National Health and Nutrition Examination Survey (NHANES) in the United States involving 11,405 participants. The study found that

HL was more prevalent among adults with diabetes than those without, with individuals with DM having approximately twice the risk of developing HL across all frequency ranges. This large-scale epidemiological study provided robust evidence for a significant association between DM and auditory dysfunction, independent of age and noise exposure.

Vaughan et al. (2006) examined the mechanisms linking diabetes to cochlear dysfunction and reported that chronic hyperglycaemia causes microvascular damage to the stria vascularis, a critical structure for maintaining the ionic balance within the inner ear. Their work highlighted the role of oxidative stress and endothelial dysfunction in cochlear microangiopathy, providing a pathophysiological basis for the elevated HL risk observed in diabetic individuals.

Kakralapudi et al. (2003) performed a large retrospective database analysis and found that SNHL was significantly more common in diabetic patients than in age-matched nondiabetic controls. The severity of HL correlated with markers of disease progression, particularly elevated serum creatinine, whereas a clear association with HbA1c was not evident in their data. These findings helped highlight the potential impact of systemic metabolic and microvascular changes in diabetes on auditory function.

Frisina et al. (2006) conducted a study on older adults with type 2 diabetes and found that women with DM were disproportionately affected by HL, suggesting a possible sex-mediated interaction between hormonal changes and cochlear vulnerability. Their findings underscored the need for sex-disaggregated data in audiological research on DM.

Glanz et al. (2015) provided a comprehensive framework in *Health Behavior: Theory, Research, and Practice*, emphasizing that health-related attitudes and awareness are fundamental predictors of preventive health behaviours. Their work on the health belief model highlighted that perceived susceptibility, severity, benefits, and barriers to action are central to understanding why individuals do or do not engage in preventive health practices. This theoretical framework is particularly relevant for understanding why adults with DM may fail to seek audiological evaluations despite being at increased risk.

Nutbeam (2000) proposed a multidimensional model of health literacy that distinguished between functional, communicative, and critical health literacy. The model argued that individuals with higher levels of health literacy are better equipped to understand health information, engage with healthcare providers, and make informed decisions. In the context of DM-related hearing loss, this work suggests that variations in health literacy across age groups may substantially influence awareness levels and health-seeking behaviour.

Indian literature

Deepthi and Kasthuri (2012) conducted a community-based cross-sectional study in rural Karnataka, India, examining awareness of diabetes complications among adults. The study found that while awareness of common complications such as diabetic retinopathy and nephropathy was moderate, awareness of HL as a complication of DM was extremely low. Less than 10% of participants were aware of any connection between DM and auditory impairment, highlighting a significant knowledge gap in rural Indian communities.

Mishra (2024) conducted a study at a tertiary care centre in India assessing the audiological profiles of patients with type 2 DM. The findings demonstrated a statistically significant association between DM and SNHL, with the majority of affected individuals falling in the 45–65 years age group. The study emphasized that SNHL in diabetic patients is progressive and is often detected at an advanced stage due to lack of routine audiological screening in diabetes care protocols.

Goel (2025) conducted a clinical study assessing HL and quality of life among diabetic patients in an Indian hospital setting. The study reported that a significant proportion of diabetic patients aged 45–65 years demonstrated moderate to severe SNHL, and that hearing impairment led to reduced social participation, emotional distress, and decreased quality of life. The study called for the inclusion of audiological evaluation as a routine component of diabetes management in Indian healthcare systems.

Hussain et al. (2025) carried out a systematic review and meta-analysis examining the prevalence and incidence of HL in individuals with DM versus non-diabetic individuals. The review reported that individuals with DM had approximately 1.83 times the risk of developing HL compared to healthy controls. Notably, even prediabetic individuals demonstrated an elevated risk, suggesting that auditory damage may begin before a formal diagnosis of DM. The study concluded that hearing screening should be initiated at the prediabetic stage to enable early intervention.

Kutty (2000) documented the health disparities between rural and urban populations in Kerala, noting that despite the state's high overall health indices, rural communities continue to face challenges in accessing specialized medical services, including audiology and diabetes care. The study highlighted that rural residents often rely on primary health centres with limited diagnostic capabilities, which contributes to underdiagnosis of complications such as HL in diabetic patients.

Collectively, the reviewed literature demonstrates a robust association between DM and HL, with consistent evidence from both Western and Indian studies. However, the research specifically examining awareness and attitudes towards DM related HL across different age groups in rural Indian settings remain sparse. This gap underscores the rationale for the present study.

Need of the Study

DM is one of the most prevalent chronic diseases in India and is associated with several complications that affect the quality of life of individuals. Among these complications, HL is an emerging but often neglected condition. Many individuals with diabetes are unaware that prolonged uncontrolled blood sugar levels can contribute to auditory damage, particularly SNHL. This lack of awareness may delay early identification and management of hearing-related problems (WHO, 2021).

In rural areas, the situation is further complicated by limited healthcare infrastructure, lack of screening programmes, and insufficient health literacy. Research indicates that awareness regarding chronic diseases and their complications is often low in rural populations, leading to delayed diagnosis and management. This is particularly relevant in regions such as Trivandrum district, where despite relatively better health indicators compared to other parts of India, disparities still exist between urban and rural communities. Rural residents may have reduced access to specialized services such as audiological assessments, and complications like HL may go unnoticed until they significantly impact quality of life (Kutty, 2000; International Diabetes Federation [IDF], 2021).

In rural areas of Trivandrum district, Kerala, access to healthcare information and specialized audiological services may be limited. Although Kerala has comparatively better health indicators, awareness regarding less recognized complications of diabetes, such as HL, may still be insufficient among the rural population. Understanding the level of awareness and attitude among adults can help identify existing misconceptions, knowledge gaps, and barriers to preventive healthcare practices (International Diabetes Federation [IDF], 2021).

Age plays an important role in shaping health awareness and attitudes. Younger adults, middle-aged adults, and older adults may differ in their understanding of diabetes-related complications, health-seeking

behaviour, and willingness to undergo screening or treatment. Conducting a comparative study among different age groups helps to determine which group lacks adequate awareness and which group demonstrates positive or negative attitudes towards diabetic HL (Nutbeam, 2000).

The use of a self-developed closed-ended questionnaire in this study provides a systematic method for assessing participants' awareness and attitudes in a structured and measurable manner. The findings of the study may help healthcare professionals, audiologists, and public health authorities develop age-specific educational programmes, awareness campaigns, and early screening initiatives for diabetes-related HL in rural communities (Glanz et al., 2015).

Therefore, this study evaluate and compare the attitudes and awareness regarding DM related HL among different age groups of adults in rural areas of Trivandrum district, Kerala, so that appropriate preventive and rehabilitative strategies can be planned for improving community health and quality of life.

METHOD

Aim of the Study

The present study aims to assess attitudes and awareness among different age groups of adults regarding DM related HL in rural areas of Trivandrum district, Kerala using a self-developed closed-ended Malayalam questionnaire. The study included mainly three age categories and a comparative study was conducted.

Participant Selection

The study consisted of mainly three groups:

Category 1: young adults (18-35 years)

Category 2: middle aged adults (36-54 years)

Category 3: older adults (55 years and above)

Inclusion criteria

The study included adults aged 18 years and above who had been residing in the selected rural areas of Trivandrum district for a minimum period of one year and who provided informed consent to participate.

Exclusion criteria

Individuals with diagnosed congenital HL, visual impairment, those with severe cognitive or psychiatric disorders that may affect communication were excluded from the study.

Procedure

The research was carried out in two stages.

Stage 1: Development of a questionnaire.

The closed ended questionnaire was developed based on the social conditions of the population. There were a total of 20 questions in two domains. The questionnaire was further validated by 5 speech language pathologists(SLPs).

Stage 2:

The study used a multiple choice questions(MCQ) questionnaire which was given to the targeted population. Participants were approached at their homes or community centres, where the purpose of the study was clearly explained and informed consent was obtained prior to participation. The questionnaire

was then administered either through face-to-face interviews for illiterate participants or as self-administered forms for literate participants, with each session lasting approximately 15–20 minutes. All data was recorded systematically while maintaining confidentiality.

RESULTS

The aim of the present study was to assess and compare the attitude and awareness among three distinct age groups of adults regarding DM related HL in rural areas of Trivandrum district, Kerala.

Table 1: Shows the awareness among three groups of adults about DM related HL

	Questions	Grp 1 (Yes)	Grp 2 (Yes)	Grp 3 (Yes)	Total (Yes)	χ^2	p-value	Significance
Q1	Are you aware of DM-related HL	15 (50%)	10 (33%)	19 (63%)	46 (51%)	5.425	.066	S
Q2	Are you aware that DM affects hearing as well as kidney and eyes	13 (43%)	7 (23%)	10 (33%)	30 (33%)	2.700	.259	NS
Q3	Are you aware that untreated DM worsens hearing	12 (40%)	3 (10%)	10 (33%)	25 (28%)	7.422	.024*	HS
Q4	Are you aware Tinnitus (ringing sound in ear) is associated with DM related HL	8 (27%)	2 (6.7%)	0 (0%)	10 (11%)	11.700	.003*	HS
Q5	Are you aware that individuals with DM are prone to ear infections	13 (43%)	8 (27%)	10 (33%)	31 (34%)	1.870	.393	NS
Q6	Are you aware that Individuals with DM related HL have difficulty in hearing conversation	12 (40%)	2 (6.7%)	20 (67%)	34 (38%)	23.067	< .001*	HS

Q7	Are you aware that individuals with DM related HL have difficulty in group conversation	10 (33%)	2 (6.7%)	10 (33%)	22 (24%)	7.701	.021*	HS
Q8	Are you aware that individuals with DM related HL have hearing difficulty in the presence of background noise	8 (27%)	5 (17%)	0 (0%)	13 (14%)	8.811	.012*	HS
Q9	Are you aware that individuals with DM related HL have difficulty in hearing in noisy environments	7 (23%)	5 (17%)	0 (0%)	12 (13%)	7.500	.024*	HS
Q10	Are you aware that Individuals with DM related HL have difficulty hearing on telephone	12 (40%)	5 (17%)	20 (67%)	37 (41%)	15.512	< .001*	HS
Q11	Are you aware that individuals with DM related HL will increase their TV volume	16 (53%)	7 (23%)	20 (67%)	43 (48%)	11.846	.003*	HS
Q12	Are you aware that individuals with DM related HL have difficulty hearing	12 (40%)	2 (6.7%)	0 (0%)	14 (16%)	20.977	.001*	HS

	women and children's voices							
Q13	Are you aware that individuals with DM related HL have perception that others speak softly/unclearly	9 (30%)	2 (6.7%)	20 (67%)	31 (34%)	24.308	.001*	HS
Q14	Are you aware that if you have reduced hearing sensitivity, you should consult ENT specialist	21 (70%)	14 (47%)	20 (67%)	55 (61%)	4.021	.134	NS
Q15	Are you aware individuals with DM should undergo routine hearing evaluation	17 (57%)	11 (37%)	20 (67%)	48 (53%)	5.625	.060	S
Q16	Are you aware that individuals with DM related HL will benefit from hearing aids	13 (43%)	6 (20%)	20 (67%)	39 (43%)	13.303	.001*	HS
Q17	Are you aware that DM-related HL is not curable by medicine/surgery	9 (30%)	3 (10%)	10 (33%)	22 (24%)	5.174	.075	S
Q18	Are you aware that healthy diet/lifestyle can prevent DM-related HL	22 (73%)	21 (70%)	30 (100%)	73 (81%)	10.588	.005*	HS

Table 1: presents the awareness of DM related HL among the three age group of adults.

The highly significant results were observed for awareness of untreated DM worsening hearing (Q3), tinnitus (Q4), hearing difficulty during conversation (Q6-Q7), hearing in the presence of background noise (Q8-Q9), telephone communication (Q10), increased television volume (Q11), difficulty hearing women's and children's voices (Q12), perception of others speaking softly or unclearly (Q13), benefits of hearing aid (Q16) and the preventive role through healthy diet and life style (Q18) ($p < 0.05$).

Group 1 of young adults showed better awareness of Q3 and Q12, while Group 2 of middle aged adults showed lowest awareness on most questionnaire items. Group 3 of older adults reported greater awareness in Q6, Q7, Q10, Q11, Q13, Q16 and Q18.

Significant results were observed for awareness of DM-related HL (Q1), routine hearing evaluation for DM individuals (Q15) and non-curable DM related HL (Q17) ($p > 0.05$). Overall group 3 performed better in Q1, Q15 and Q17 compared to other groups. In contrast no significant differences were observed for awareness of DM related HL (Q2), awareness of DM causing ear infection (Q5) and need to consult an ENT (Q14). Although no significant results were observed, Group 1 performed better than the other two groups in questions 2, 5 and 14.

Table 2: Shows a summary of overall awareness about DM related HL among three groups of adults

Age range	18- 35 years	36-54 yrs	54+ yrs
Participants overall %	42.4	23.17	42.78

Figure 1: Shows an overall summary of awareness

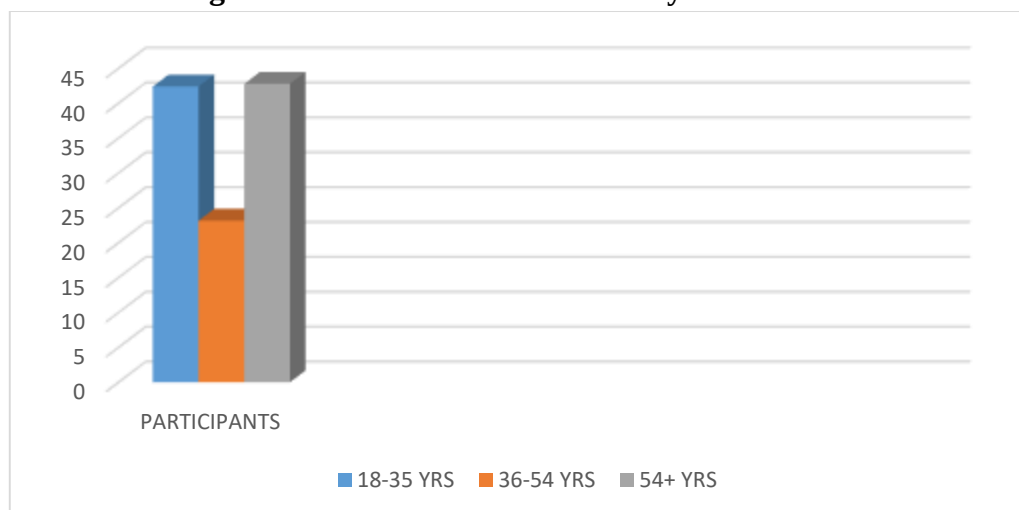


Table 2 and figure 1 revealed the overall awareness about DM related HL among three group of adults. The findings showed that middle aged adults in group 2 (36-54 years) have poor awareness (23.17%) about DM related HL while group 1 of young adults (18-35 years) and group 3 of older adults (54+ years) revealed higher awareness levels (42.4% and 42.78% respectively).

Discussion

The study assessed attitudes and awareness among different age groups of adults about DM related HL in rural areas of Trivandrum district in Kerala. The findings of the current study indicate that awareness regarding DM related HL varies across age groups in rural Trivandrum, with the 36–54 age demographic

exhibiting the lowest level of awareness (23.17%) followed by 18-35 age(42.4%) and 54+ age(42.78) . This observation aligns with existing literature on diabetes health literacy in rural Indian settings. The results of the current study are in accordance with the community-based cross-sectional study conducted by Deepthi and Kasthuri (2012) in rural Karnataka which revealed that less than 10% of participants were aware of any connection between DM and auditory impairment, highlighting a significant knowledge gap in rural Indian communities. This level of low awareness in the current study highlights the need for targeted awareness and educational programmes to help promote early identification and management on DM related HL in rural areas.

Conclusion

The findings of this study revealed that awareness regarding DM related HL varies significantly across age groups in the rural areas of Trivandrum district, with the middle-aged demographic (36–54 years) exhibiting the poorest level of awareness followed by young aged(18-35 years) adults and older(54+ years) aged adults. This critical gap in awareness highlights a vulnerable population that may overlook the early onset of auditory complications, delaying necessary intervention.

To address this deficit, audiologists must play a pivotal role in public health and inter-professional care frameworks within rural communities. Audiologists are essential in designing and implementing targeted educational campaigns and community outreach programs specifically tailored to middle-aged adults, raising awareness about the impact of chronic hyperglycaemia on the auditory system. Furthermore, by collaborating with primary care physicians, diabetologists and rural health workers, audiologists can establish routine audiological screening protocols for individuals diagnosed with DM. This proactive involvement ensures early identification, timely management of hearing impairment, and a comprehensive approach to improving the overall quality of life for diabetic patients in rural settings.

Limitations

Limited sample size.

The study was conducted in selected rural areas of Trivandrum districts only.

Future directions

Sample size can be increased.

The study can be conducted in other districts of Kerala.

A comparative study can be conducted on the awareness of individuals about DM related HL in rural and urban areas.

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