



Association Between Self-Reported Hearing Impairment and Diabetes Mellitus

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Abstract
Background: Hearing loss is a growing global health problem in the United States of America. It affects about ten to fifteen percent of the majority adult Americans and about 70 % of persons 70 years old. The burden of diabetes is expected to increase throughout the world as a result of people living longer and adopting healthier lifestyles. To determine the relationship between self-reported hearing impairment and diabetes in Kirkuk, Iraq.
Methods A cross-sectional study. The study was applied to 40-60 year-old diabetic patients in health centers in the city center of Kirkuk in Iraq between 20 March / March 2022 and 20 / May / 2022. The Hearing Handicap Inventory for the Adult (HHIA) data are collected using the 'The Hearing Handicap Inventory for Adults (HHIA)'. By the self-report approach.
Results: The result showed that the majority of self-reported hearing impairments in patients with diabetes in Iraq / Kirkuk city were moderate, approximately 55.8%. More than half of the participants demonstrated moderate hearing loss. Age groups and levels of education are contributing factors to hearing loss in patients with diabetes.
Conclusions There was a significant difference in scale scores between diagnosis time groups and treatment types. Organizing a diabetes-specific activist group to raise awareness of the risk of hearing loss in the community.

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INTRODUCTION

Hearing impairment, whether related to age or associated with other health conditions, poses a unique set of challenges for affected individuals (Jafari et al., 2019; Sharma et al., 2021). Communication difficulties, social isolation, and decreased quality of life are common consequences (Weinstein, 2019). Diabetes, on the other hand, is a complex metabolic disorder characterized by high blood sugar levels, with complications ranging from cardiovascular disease to neurological problems (Bisogno et al., 2021). Although the impact of diabetes on various organ

systems is well documented, its potential association with hearing impairment requires closer investigation (Wittich & Simcock, 2019). Hearing impairment and diabetes are two prevalent health concerns that significantly impact the quality of life of people around the world (Baiduc & Helzner, 2019; Li et al., 2020). Both conditions have substantial public health implications and contribute to the global burden of disease (Samocho-Bonet et al., 2021). Although extensive research has explored the individual characteristics and consequences of hearing impairment and diabetes, limited attention has been paid to understanding the potential interconnection

between these two health issues, particularly in the context of Iraq and, more specifically, Kirkuk City.

Iraq, a country with a rich cultural heritage and a history shaped by various social, economic, and political factors, faces a growing health challenge due to the increasing prevalence of chronic diseases such as diabetes. The increasing incidence of diabetes in Iraq has led researchers to explore its multifaceted implications in various aspects of health. However, the relationship between diabetes and hearing impairment remains a relatively unexplored area, both globally and within the specific regional context of Kirkuk City.

This study aims to bridge the existing knowledge gap by investigating the association between self-reported hearing impairment and diabetes in the Kirkuk City population, Iraq. Understanding the potential link between these two prevalent health conditions is crucial for the formation of public health strategies, the improvement of patient care, and overall well-being in this region. By shedding light on this association, we can pave the way for targeted interventions, early detection, and improved management of these health concerns, ultimately contributing to a healthier and more resilient community in Kirkuk City.

Study design and population:

The study used a cross-sectional design and focused on diabetic patients aged 40-60 years in health centers within Kirkuk City, Iraq. Data collection took place between 20 March 2022 and 20 May 2022. The research aimed to achieve a population size of 140, with a 95% confidence interval, a 5% error rate (α), and a power of 80% power ($1-\beta$). The determination of the sample size, considering ANOVA and independent t-test analyses, resulted in a sample of 104 patients to maintain optimal statistical power. The inclusion criteria for this study included people who expressed a voluntary willingness to participate, were adults between 40 and 60 years of age, had received a diabetes diagnosis at least 6 months prior, and demonstrated good cognitive function and ease of verbal communication. On the contrary, the exclusion criteria included people who did not participate, those with a cancer diagnosis, people experiencing immobility or physical disabilities, and those with impaired cognitive function that could significantly affect effective communication.

Data Collection Tools:

The demographic information form for the patient consisted of 19 questions that included

sociodemographic characteristics, health status, disease details, and drug use. Furthermore, the study used the Hearing Handicap Inventory for Adults (HHIA), a self-assessment scale that consists of 25 items with response options of yes, no, or sometimes. The scores were assigned as follows: Yes (4 points), no (0 points), and Sometimes (2 points). The total scores were then classified into three levels: 0-17, indicating no barriers, 18-42, indicating mild to moderate disability, and 43 or more, indicating a significant obstacle. HHIA, validated in Arabic, demonstrated excellent internal consistency and reproducibility in this study.

Statistical analysis:

Statistical analysis performed using IBM SPSS 26 and Microsoft Office Excel 365. Normality assessed using the Kolmogorov-Smirnov / Shapiro-Wilk tests. Descriptive statistics are presented as (mean \pm standard deviation) or (median and min-max). Categorical variables analyzed using Pearson / Fisher exact chi-square tests. Continuous data assessed with the t test or the Mann-Whitney U test based on distribution. Correlation and linear regression analysis was used to explore the relationships between variables. Significance set at $p<0.05$.

Ethical Considerations:

Approval obtained from the Ethics Committee of Ankiri Karatkin University and the Iraqi Ministry of Health / Environment. Permissions obtained from the directors of Azadi Teaching Hospital, Kiwan Health Center, and Diabetes Housing Health Center. Participants provided their informed consent and were assured of voluntary participation and the right to withdraw at any stage.

RESULTS:

When analyzing the study results, the majority of participants, mainly 50-60 years old with a mean age of 50.56 ± 6.70 years, showed a balanced gender distribution (56.7% male, 43.3% female) and a prevalent marital status of 86.5%. A substantial portion of the cohort had children (79.8%) and possessed at least a bachelor's degree (30.77%). In occupation, the participants showed diversity, with 25% housewives, 30.8% officers and 10.6% workers. Residency predominantly included city / metro areas (42.3%) and 23% of the participants had health insurance coverage. Regarding the history of diabetes mellitus (DM), the study identified a predominant occurrence of Type 1 diabetes (57.7%) with an average duration since diagnosis of 9.63 ± 6.408 years, and insulin needles were the main treatment method (53.8%). The Adult Hearing Handicap Inventory (HHIA)

revealed varying levels of hearing impairment, with mean scores indicating moderate impairment (53.7 ± 16.5), emotional subdimension scores at 26.0 ± 8.5 , and situational subdimension scores at 27.7 ± 8.9 . In the evaluation of the total HHIA scores, 31.7% reported no handicap, 51.9% mild-moderate handicaps, and 16.4% severe handicaps. Relationship analyzes also indicated significant

correlations between self-reported hearing impairment and age, educational level, time since diagnosis, type of treatment and specific complications ($p < 0.05$). These findings collectively underscore the multifaceted nature of hearing impairment within the diabetic population, highlighting the need for customized interventions and comprehensive care strategies.

Table 1: Distribution of the study sample related to the sociodemographic characteristics of patients with diabetes in Iraq/Kirkuk City.

Variable	Group	Frequency	%
Age	40-49	49	45.19
	50-60	55	54.81
	Total	104	% 100
	Mean + SD = 50.56 ± 6.70 years		
Gender	Male	59	56.7
	Female	45	43.3
	Total	104	100.0
	Total	104	100.0
Occupation	Housewife	26	25.0
	Officer	32	30.8
	Worker	11	10.6
	Retired	15	14.4
	Self-employed	5	4.8
	Not working	15	14.4
	Total	104	100.0
Type of diabetes	Type 1 diabetes	60	57.7
	Type 2 diabetes	36	34.6
	GDM	8	7.7
	Total	104	100
	6 (months) - 10 years	70	67.3
Time since diagnosis	11-20 years	26	25.0
	21-30 years	8	7.7
	6 months -30 years	104	100.0
	Mean + SD = 9.63 ± 6.408		
	Type of treatment	diabetes drugs	48
insulin needles		56	53.8
Total		104	100.0

Table 2 Adult Hearing Handicap Inventory (HHIA) for patient diabetes

Hearing impairment	No		Sometimes		Yes		Mean
	F	%	F	%	F	%	
Does a hearing problem cause you to use the phone less often than you would like?	19	18.3	44	42.3	41	39.4	2.21
Does a hearing problem make you feel embarrassed when meeting new people?	13	12.5	57	54.8	34	32.7	2.20
Does a hearing problem cause you to avoid groups of people?	23	22.1	43	41.3	38	36.5	2.14
Does a hearing problem make you irritable?	16	15.4	34	32.7	54	51.9	2.37
Does a hearing problem make you feel frustrated when talking to members of your family?	27	26	42	40.4	35	33.7	2.08
Does a hearing problem cause you difficulty attending a party?	20	19.2	51	49.0	33	31.7	2.13
Does a hearing problem make you feel 'stupid' or 'dumb'?	17	16.3	48	46.2	39	37.5	2.21
Do you have difficulty hearing someone speaks in a whisper?	35	33.7	38	36.5	31	29.8	1.96
Do you feel handicapped by a hearing problem?	25	24.0	48	46.2	31	29.8	2.06
Does a hearing problem cause you difficulties when visiting friends, family, or neighbors?	29	27.9	49	47.1	26	25.0	1.97
Does a hearing problem cause you to attend religious services less often than you would like?	28	26.9	39	37.5	37	35.6	2.28
Does a hearing problem cause you to be nervous?	16	15.4	41	39.4	47	45.2	2.30
Does a hearing problem cause you to visit friends, family, or neighbors less often than you would like?	18	17.3	54	51.9	32	30.8	2.13
Does a hearing problem cause you to have arguments with family members?	21	20.2	57	54.8	26	25.0	2.05
Does a hearing problem cause you difficulty listening to TV or radio?	35	33.7	39	37.5	30	28.8	1.94
Does a hearing problem cause you to go shopping less often than you would like?	42	40.4	31	29.8	31	29.8	1.89
Does your hearing problem or difficulty bother you at all?	30	28.8	48	46.2	26	25.0	1.96
Does a hearing problem make you want to be alone?	29	27.9	42	40.4	33	31.7	2.04
Does a hearing problem cause you to talk to family members less often than you would like?	20	19.2	55	52.9	29	27.9	2.09
Do you feel that difficulty with your hearing limits limits or hampers your personal or social life?	27	26.0	46	44.2	31	29.8	2.03
Does a hearing problem cause you difficulties when you are in a restaurant with family or friends?	33	31.7	42	40.4	29	27.9	1.96
Does a hearing problem make you feel depressed?	30	28.8	36	34.6	38	36.5	2.08
Does a hearing problem cause you to listen to television or radio less often than you would like?	26	25.0	46	44.2	32	30.8	2.05
Does a hearing problem make you uncomfortable when talking to friends?	32	30.8	39	37.5	33	31.7	2.01
Does a hearing problem make you feel left out when you are?	35	33.7	40	38.5	29	27.8	1.94

Table 3 Distribution among hearing impairments of participants in the study

	F	%
No handicap (0-8)	33	31.7
Mild-moderate (10-24)	54	51.9
Severe (26.40)	17	16.4
Total	104	100.0

Table 4: Relationship between demographic data and self-reported hearing impairment.

Variable	F/t value	p-value
Age	-2.757*	0.007
Gender	0.960	0.386
Occupation	0.271	0.763
Type of diabetes	0.910	0.406
Time since diagnosis	0.255#	0.009
Type of treatment	-2.607**	0.011

Table 5: Relationship between patient diabetes mellitus complications and self-reported hearing impairment.

Variable	t-value	p-value
Double vision	2.043	0.135
Diabetic foot	2.051	0.134
slow healing wound	2.659	0.075
Stroke/angina pectoris	4.665	0.012
Kidney problems	1.599	0.207
Fine nerve damage	0.720	0.489
Gum problems	0.334	0.717
Problems with the husband	7.427	0.001

DISCUSSION

This section comprehensively interprets and discusses the study findings in light of the research objectives, drawing support from relevant literature. The age distribution of the participants, with more than half falling within the 50-60 age group, is in agreement with the study by Soares et al. (2018), where a similar trend was observed (Ponte et al., 2023). However, these results contrast with those of Kim et al. (2017), indicating the need to consider regional variations and demographic differences (Kim et al., 2017). The gender distribution in this study, with more male participants, diverges from the findings of Zhang et al. (2019), (Zhang et al., 2019) but aligns with Kim et al. (2017). The prevalence of hearing impairment in men found in Brazilian research (Sachdeva & Azim, 2018)

offers a potential explanation for this gender-based difference (Sachdeva & Azim, 2018). Contrary to the study by Nuesse et al. (2021), which noted a low level of education among diabetes patients, less than one third of our study had a bachelor's degree (Nuesse et al., 2021). This discrepancy highlights the diverse educational background within the study population. In particular, the unexpectedly high prevalence of Type 1 diabetes challenges previous assumptions about the prevalence of diabetes in Iraqi societies, deviating from the norm reported by Meneses-Barriviera et al. (2018) (Meneses-Barriviera et al., 2018). In our study, complications of diabetes, including double vision, kidney problems, gum problems, slow-healing wounds, and stroke/angina pectoris, were prevalent, providing new information on the specific complications facing this population. The novel contribution of the study lies in revealing a substantial prevalence of hearing impairment among patients with diabetes. The findings substantiate the need for ongoing research to understand the etiological factors that link diabetes and hearing impairment, promoting the development of targeted preventive measures. The study highlights a significant association between hearing impairment and age, educational level, and specific complications such as stroke / angina pectoris. This is consistent with studies by Lee et al. (2015), Kim et al. (2017), and Spankovich & Yerraguntla (2019), which emphasize the enduring relationship between diabetes and hearing loss, even after accounting for confounders variables (Lee et al., 2015; Spankovich & Yerraguntla, 2019). The study underscores the importance of glycemic control in diabetes, as indicated by the correlation between HbA1c levels and the risk of hearing loss (Kim et al., 2017). Furthermore, the prevalence of mild to moderate hearing impairments in approximately half of the participants requires increased attention at the local and national levels, emphasizing the urgency of targeted interventions and further research. Although the study contradicts some previous findings on the relationship between diabetes and incident hearing loss, it aligns with others that emphasize the multifactorial nature of risk factors for hearing impairment. The unexpected link between diabetes and hearing loss, particularly in the worst and best ears at all degrees and frequencies, underscores the urgency of comprehensive healthcare strategies. The connection between diabetes and hearing impairment, even after considering confounding factors, implies a complex interplay

between various elements. Smoking emerges as a notable risk factor, aligning with previous studies linking smoking with higher odds of hearing loss (Alizadeh et al., 2022; Gioacchini et al., 2023; Shafiepour et al., 2022). The study's exploration of complications, such as sexual partner as significant contributors to self-reported hearing impairment, adds a unique dimension to the existing literature.

CONCLUSIONS

In conclusion, this study provides valuable information on the intricate relationship between diabetes and hearing impairment, shedding light on demographic variations and unexpected prevalence rates. These findings underscore the need for targeted public health interventions, focusing on prevention of hearing loss in patients with diabetes. The observed correlations between education, age, and specific complications highlight the need for nuanced and personalized healthcare approaches. Although the study revealed new associations, it also emphasizes the need for continued research in this domain to refine our understanding of the intricate links between diabetes and hearing impairment, ultimately facilitating the development of effective preventive measures and interventions.

This research study, titled '**Association between self-reported hearing impairment and Diabetes in Iraq / Kirkuk City**', was conducted by **IMAN AL RASHEED AL-KH L¹ Asst. Prof. Dr. Taner AKARSU²** has received ethical approval from the Ethics Committee of **the Graduate School of Health Sciences at Ankr Karatekin University**.

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Study the concept, write and review the final edition by all authors.

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