

**ORIGINAL-RESEARCH-ARTICLE****Hearing impairment determinants in adults**Rabah Salih Mohammed Al. Ali ¹ | Fatima Khalid Abdulmalik Al. Shafer ²

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Abstract

Background: Hearing impairment (also known as hearing loss) is now firmly established as a public health problem. It is considered as disabling disease in many countries, and for this reason, the investigations for the risk factors that are associated with this disorder are very important. **Aim:** To establish the risk factors of adults hearing loss and its preventive measures. **Method:** In a retrospective analysis case-control study, medical records of 100 patients who had a hearing impairment (cases) and 100 patients who had not hearing loss were taken in ENT outpatient at AL Basrah teaching hospital. They were unmatched individuals for both age and sex and they were evaluated between March and September, 2019. The data was mainly obtained from cases and controls by the investigator through direct interview procedure. **Result:** In this study the majority of cases of hearing loss was gradual in onset (97%), bilaterally located (72%) and of a mixed type (48%). Finding about the association of gender with hearing loss in the current study express that hearing loss had a positive significant association with the male gender. (O.R=2.125, P value=0.015, C.I= 1.15-3.94); with male :female ratio about 2:1. The highest age specific groups of the cases were > 45 years old which constitute about 67% with mean age group 51±14.09. The result of the present study indicate a highly positive significant association between hearing loss and partial skilled occupation. A person who exposed to stress and economic factors was found to be around 2-3 times more prone to develop hearing loss. Hearing loss had a positive significant association with the illiterate persons. A positive family history is found to be a significant risk factor in the development of hearing loss. A highly significant relation between noise exposure and the development hearing loss. The result of the present study indicate a significant association between current smoking & passive smoking and the development of hearing loss. A positive association between hearing loss and, manual skilled occupation, geographical mobility, urbanization, overcrowding houses, diuretics, and NSAIDs drugs history were founded. **Conclusion:** Age more than 45 years old was highly associated with development of hearing loss. Males sex are more common than females sex in the distribution of cases of hearing loss in a ratio about 2:1. In this work, partially skilled occupations, currently and passively cigarettes smokers, carried a high positive significant association with hearing loss; while semi-professionals and unskilled occupations family history of hearing loss, type A personality, presence of life stressors, economical factors excessive noise exposure, type II D.M illiterates, carried amino glycoside drugs users had a significant protective association with hearing loss.

Keywords: Outcome, prevalence rate, ENT outpatient unit, Hearing loss.

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1|INTRODUCTION

Hearing loss is a complaint that can reflect a wide variety of abnormalities of hearing and requires different considerations in adults.

Hearing impairment is the most frequent sensory deficit in human populations, affecting more than 250 million people in the world. Affect nearly 10% of the world population. Evaluation should determine whether the loss is unilateral or bilateral, acute, progressive, or fluctuating in nature ⁽¹⁾. The time course of the hearing loss should be established and associated symptoms of aural fullness, pain, otorrhea, vertigo, tinnitus, or cranial neuropathies documented. The medical history should investigate current and past treatments with oral and intravenous medications, as well as non-prescription drug use. The patient should be screened for systemic diseases, including cardiovascular, metabolic, endocrine, neurologic, hematologic, and autoimmune diseases. Prior ear surgery, cardiac bypass surgery, and lumbar puncture also may be relevant to the current complaint of hearing loss. A family history of hearing loss, neoplasm, renal disease, and balance disorders should be obtained. Finally, previous sharp or blunt head trauma, noise trauma, or barotraumas should also be noted ⁽²⁾.

Hearing loss is now firmly established as a public health problem. It is considered as disabling disease in many countries, and for this reason, the investigations for the risk factors that are associated with this disorder are very important ⁽³⁾.

The population-based Epidemiology of Hearing Loss Study was designed to measure the prevalence of hearing loss in adults aged above 20 years, hearing loss is one of the most common self-reported conditions. In People with a hearing loss were more likely to report a hearing handicap, the prevalence of hearing loss increased greatly with age, and men were more likely to be affected than were women ⁽⁴⁾. Under normal conditions the most effective sound waves are those transmitted across the drumhead and the chain of ossicles to the oval window ⁽⁵⁾. Conductive hearing loss” means a permanent hearing threshold shift of at least 25 decibels (dB) in the frequency of 500, 1,000, 2,000 or 4,000 hertz (Hz) ^(6,7). Sensorineural hearing loss occurs due to inner ear problems in which the defect is extended from the cochlea up to auditory center in the brain ^(8,9). Both types of hearing loss have many etiological factors ⁽¹⁰⁻²⁷⁾. Also social risk factors that are contributing for the development of many Non communicable diseases seems to be sufficient ⁽²⁸⁻⁴²⁾. This study aimed to establish the risk

factors of adults hearing loss and its preventive measures , To determine the prevalence of hearing loss in adults, categorize risk factors into dependent and independent according to statistical regression analysis and formulate possible preventive programmes for hearing loss in adults .

2 | METHODS

2.1| Setting, Study design and patients

To achieve the aim of the present study a case-control study design was adopted . The study was conducted in ENT outpatient consultation unit in AL-Basrah teaching hospital, Basra, Iraq. This unit is the main ENT outpatient clinic in Basrah Governorate. Also it is the main referral level for other hospitals and primary health care centers in Basrah Governorate. This clinic was provided with computer services for data collection.

The data was mainly obtained from cases and controls by the investigator through direct interview procedure. A detailed questionnaire form was prepared to record all the relevant information related to cases and controls in the sample. (100) Cases were ENT consulting patients who consulted the ENT outpatient consultation unit in AL-Basrah teaching hospital who have hearing impairment for any cause. They were collected consecutively. (100) Controls were individuals free from hearing impairment who attended the ENT outpatient clinic of AL-Basrah teaching hospital. They were unmatched individuals for both age and sex variables.

Ethical Approval: This study was conducted according to the written approval agreement of the Training & Development Department of the Health Directory of Basrah governorate and a verbal consent was obtained through personal communication.

Statistical analysis: All analysis was performed using SPSS version 26.0, in addition to Graph Pad

Supplementary information The online version of this article (<https://doi.org/10.52845/JORR/2024/5.2.2>) contains supplementary material, which is available to authorized users.

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Prism version 8.4.3, wherein descriptive statistics were applied to analyze these data. Numerical variables were expressed as frequencies and percentages. P-value (probability value) was found to be significant if $P\text{-value} \leq 0.05$, very significant ≤ 0.01 and highly significant when $P\text{-value} \leq 0.001$.

3 | RESULTS

The majority of cases and controls were between the age of 45 to 70 years, The mean ages of cases was higher than that of controls; 51 ± 14.09 and 48.9 ± 18.46 , respectively (Figure 1).

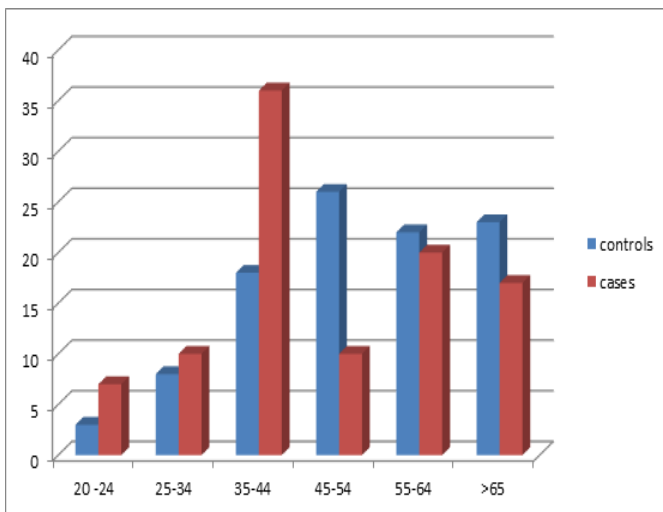


Figure (1) Age distribution of hearing loss of cases and their controls

Males were more than females in both cases and controls (Figure 2).

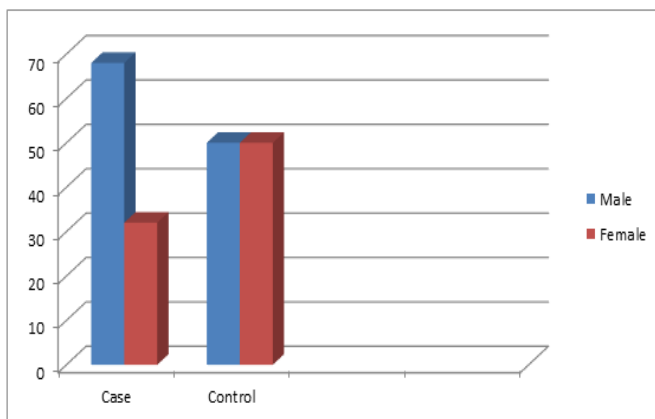


Figure (2) Gender distribution of the study population

Never the less, Figure (3) shows that the Urban is larger than the rural in both cases and control.

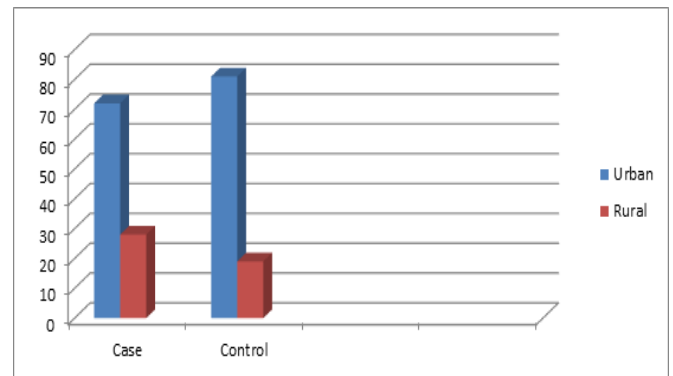


Figure (3) The Geographical distribution of the study population

majority of cases have manual occupations (manual skilled, partially skilled and unskilled). Regarding the controls the majority are unskilled and semi professional and non manual skilled as in (figure 4)

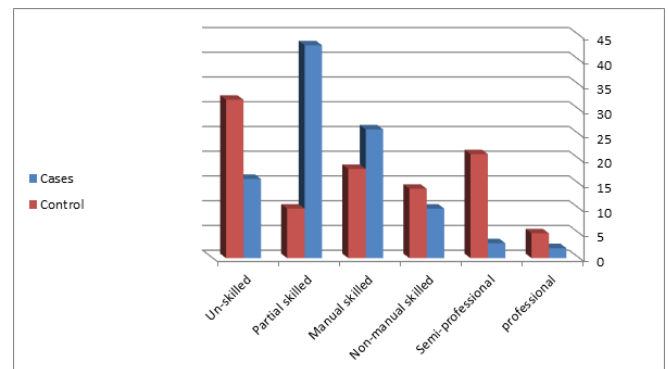


Figure (4) Distribution of the study sample according to their occupation

Most cases are of mixed type of hearing loss with gradual onset and by late rally located (figure 5,6)

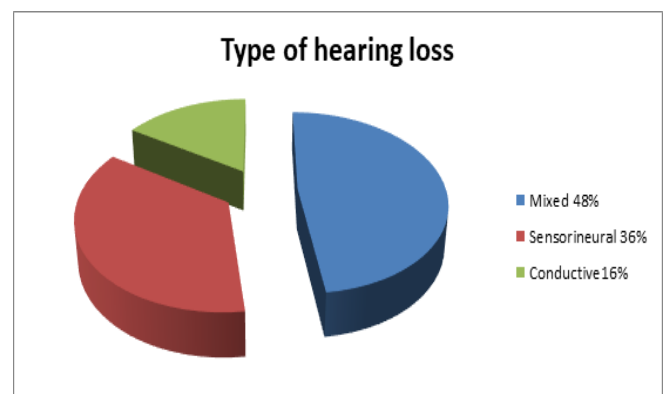


Figure (5) Type of Hearing loss in the cases

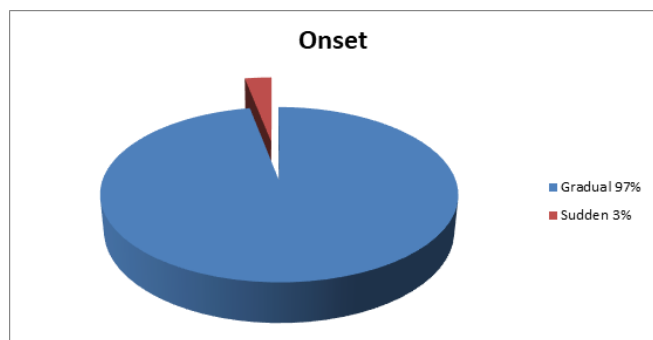


Figure (6) Onset of hearing loss in the cases

A significant relationship between hearing loss with increasing age was found (OR = 2.76, P value = 0.0006, CI = 1.59-4.95).

The result of the present study indicate a highly positive significant association between hearing loss and partial skilled occupation (OR = 6.79, P value = 0.00001, CI = 3.16-14.57); On other hand the present study shows a protective relation between hearing loss and semi- professional & unskilled occupations (OR =0.12, P value=0.0001,CI=0.030.4) (OR=0.4, P value=0.008, CI=0.2-0.80) respectively.

A person who exposed to stress and economic factors was found to be around 2-3 times more prone to develop hearing loss than those who an exposed to these factors ;this association seems to be significant (OR=2.2, P value=0.0380, CI=1.04-4.72) , (OR=3.21, P value=0.025,CI=1.12-9.60) respectively. Finding about the association of education with hearing loss in the current study express that hearing loss had a positive significant association with the illiterate persons (OR=2.88, P value=0.025, CI=1.12 -7.56); also it shows a significant association in those who are completed the secondary school grade(OR=2.09, P value=0.024 ,CI=1.09-3.98).At the same time this table signify a protective relation with those who are completed a collage grade(OR=0.37, P value= 0.012 ,CI=0.16-0.82).

A positive family history is found to be a significant risk factor in the development of hearing loss (O.R=4.97, P value=0.0157, C.I=1.35-18.25). A highly significant relation between noise exposure and the development hearing loss (O.R=3.89, P value=0.0167, C.I:1.38-11.01). A significant relation between history of diabetes mellitus and development of hearing loss was found (OR = 4, p value = 0.0266, CI = 1.08-14.79). Also this study demonstrate a significant association between the history of use of amino glycosides drugs and subsequent development of hearing loss (OR = 8.61,

P value = 0.0170, CI = 1.05-70.17) . The result of the present study indicate a significant association between current smoking &passive smoking and the development of hearing loss (O.R=2.08, P value = 0.020, C.I:1.07-4.08),(OR=2.54, P value=0.0034, CI=1.07-6.16) respectively. There were high prevalence of wax ,A.O.M, C.O.M, presbycusis and cholesteatoma in the cases (40%,12%,18%,18% and 12%) respectively, in contrast to low prevalence rate in the control sample. A positive association between hearing loss and, manual skilled occupation (OR = 1.6, C.I = 0.81-3.15), geographical mobility (OR = 1.46, C.I = 0.68-2.96), urbanization (OR = 1.42, C.I = 0.68-2.96), overcrowding houses (OR = 1.2, C.I = 0.6-2.39), diuretics and NSAIDs (OR = 2.04, C.I = 0.35-2.29) , although there is no significant association was noticed between hearing loss and the following variables : residence, other social factors, other drugs and other systemic disease as shown in (table 1) to (table 11) .

Table (1) Association between Hearing loss and Gender of the study population.

Gender	Cases		Controls		O. R	P-Value*	C.I
	No.	%	No.	%			
Male	68	68	50	50	2.125	0.015	1.15-3.94
Female	32	32	50	50			
Total	100	100	100	100			

*based on X² test d. f=1

Table (2) Association between hearing loss and the residence of the study population.

	No.	%	No.	%			
Urban	82	82	75	75	1.591	0.302	0.73-3.17
Rural	18	18	25	25			
Total	100	100	100	100			

*based on X² Test d. f=1

Table (2) Association between hearing loss and the residence of the study population.

Occupation	Cases		Controls		O. R	P-Value*	C.I
	No.	%	No.	%			
Professional	2	2	5	5	0.39	0.2484	0.07-2.05
Semi-professional	3	3	21	21	0.12	0.0001	0.03-0.40
Non-manual skilled	10	10	14	14	0.68	0.3841	0.29-1.62
Manual skilled	26	26	18	18	1.60	0.1721	0.81-3.15
Partial skilled	43	43	10	10	6.79	0.00001	3.16-14.57
Un-skilled	16	16	32	32	0.40	0.0081	0.21-0.80

*based on X² test d. f=1

Table (4) shows the association between hearing loss and the age of the study population.

Age	Cases		Controls		O. R	P-Value*	C.I
	No.	%	No.	%			
More than 45 years	71	71	47	47	2.76	<0.0006	1.59-4.95
Less than 45 years	29	29	53	53			
Total	100	100	100	100			

*based on X^2 test $d.f=1$

Table (5) association between the hearing loss and smoking habit. of the study population

Smoking habit	Cases=100		Controls=100		O. R	P-Value*	C.I
	No.	%	No.	%			
Current Smokers	33	33	22	22	2.08	0.020	1.07-4.08
Former smokers	22	22	31	31	0.88	0.660	0.46-1.64
Passive smoking	22	22	10	10	2.54	0.034	1.07-6.16
Non-smokers	34	34	37	37	0.59	0.105	0.32-1.11

*based on X^2 test $d.f=1$

Table (6) the relation between life events and the development of hearing loss

Life events	Cases		Control		OR	P-value*	C.I
	No.	%	No.	%			
Stress							
Present	28	28	15	15	2.20	0.0380	1.04-4.72
Absent	72	72	85	85			
Social discontinuities							
Present	34	34	41	41	0.74	0.3066	0.42-1.32
Absent	66	66	59	59			
Geographical Mobility							
Present	20	20	15	15	1.42	0.3523	0.68-2.96
Absent	80	80	85	85			
Catastrophic Events							
Present	6	6	7	7	0.85	0.7742	0.27-2.62
Absent	94	94	93	93			

*based on X^2 test $d.f=1$

Table (7) Association of social context and the development of hearing loss.

Social context	Cases		Control		OR	P-value*	C.I
	No.	%	No.	%			
Economical factor							
Present	17	17	6	6	3.21	0.0250	1.12-9.60
Absent	83	83	94	94			
Social disintegration							
Present	4	4	7	7	0.55	0.3521	0.16-1.95
Absent	96	96	93	93			
Urbanization							
Present	20	20	15	15	1.42	0.3523	0.68-2.96
Absent	80	80	85	85			
Persons in household>8							
Present	22	22	19	19	1.2	0.5993	0.60-2.39
Absent	78	78	81	81			

*based on X^2 test $d.f=1$

Table (8) The relation between hearing loss and the educational level of the participant

Educational level	Case		Control		OR	P-value*	C.I
	No	%	No	%			
Illiterate	20	20	8	8	2.88	0.025	1.12-7.56
Primary school	25	25	35	35	0.56	0.09	0.29-1.08
Secondary school	41	41	25	25	2.09	0.024	1.09-3.98
Collage & Institute	12	12	27	27	0.37	0.012	0.16-0.82
Higher education	2	2	5	5	0.39	0.442	0.05-2.33

*based on X^2 test $d.f=1$

Table (9) association between hearing loss and it's family history of the study population.

Family History	Cases		Controls		O. R	P-Value*	C.I
	No.	%	No.	%			
Present	12	12	3	3	4.97	0.0157	1.35-18.25
Absent	88	88	97	97			
Total	100	100	100	100			

*based on X^2 test $d.f=1$

Table (10) association between hearing loss and noise

Noise	Cases		Controls		O. R	P-Value*	C.I
	No.	%	No.	%			
Present	17	17	5	5	3.89	0.0067	1.38-11.01
Absent	83	83	95	95			
Total	100	100	100	100			

*based on X^2 test $d.f=1$

Table (11) Association between hearing loss and systemic diseases of the study population

Systemic diseases	Cases		controls		O. R	P-Value *	C.I
	No.	%	No.	%			
D.M	11	11	3	3	4	0.0266	1.08-14.79
C.V. D	4	4	4	4	1	1.0000	0.24-4.12
Renal failure	1	1	0	0	1	0.3161	0.06-16.21
Hematology	2	2	2	2	1	1.0000	0.14-7.24
Auto-immune	2	2	3	3	0.66	0.6506	0.11-4.04
Migraine	1	1	2	2	0.49	0.5607	0.04-5.55
C.V. A	1	1	1	1	1	1.0000	0.06-16.21
Hypothyroid	1	1	1	1	1	1.0000	0.06-16.21

*based on X^2 test $d.f=1$

4 | DISCUSSION

This result agreed with that of Reuben et al (43), 2004 who showed that the cases of hearing loss are more common in male gender than female. The present study shows a significant relation between age more than 45 years old and the subsequent development of hearing loss (O.R=2.

2.76, C. I: 1.59-4.94). This result is in agreement with Brant et al ⁽⁴⁵⁾, in a case-control study conducted at 2006 who clarify a highly significant relation between aging process and hearing loss. This association can be explained by presbycusis. The analysis of results regarding occupation show a positive relation between hearing loss and partially skilled occupations (O.R=6.79, CI=3.16-14.57) indicating a significant positive association between occupational and individual activities with current state of hearing. On other hand the present study shows a protective relation between hearing loss and semi- professional & unskilled occupations (OR=0.12, CI=0.030.4) (OR=0.4, CI=0.2-0.80) respectively. This may be explained on the basis of that partially skilled occupations having more mechanical, traumatic and noise burden on the auditory system of the body, while semi-professional and unskilled occupation have not such a burden as in the first group. This result was agreement with that of daiell et al⁽⁴⁶⁾, in a case-control study conducted in 2005, who observed a significant association between occupational hazards and symptoms of hearing loss appearance. The result of the study indicate a significant association between current smoking & passive smoking and the development of hearing loss (O.R=2.08, C.I:1.07-4.08) (OR=2.54, CI=1.07-6.16) respectively .This result agreed with Cruickshanks et al ⁽⁴⁷⁾, who found that the current smokers as well as passive smokers at higher risk of having hearing loss later .There is no biological explanation of why smoking may cause hearing loss .Smoking may affect the vascularity of auditory system as well as the effect of many toxins-containing cigarette in additional to many socioeconomically complications that may lead to hearing loss. There is some evidence that stress, and more specifically an individual's capacity to control their stress level, may play a role in etiology of hearing loss. In a study conducted by Rarey et al⁽⁴⁸⁾, in 2001 ,it found that the stress is a significant risk factors for hearing loss especially those persons with type A personality. The present study shows a significant association between stress, type A personality and hearing loss (OR=2.2, CI=1.04-4.72). This probably explained by the stress theory through the effect of stress on the hypothalamic-pituitary-adrenal axis and cortisol over production that affect cochlear system which may associated with increased

psychological distress and this contribute to increase risk of hearing loss. In this study Changes in the economical state appeared in this study to share strongly with other participating factors in rising up of hearing loss among adults (OR=3.21, CI=1.12-9.60). Other researcher provides a similar opinion regarding unemployment and other economic factors with the development of hearing loss. Marmot et al ⁽⁴⁹⁾ is an example of them. The interpretation of those findings is not straightforward, as (1) health factors underlying the transition into economic inactivity are likely to be more sever and perhaps different from those attached to mobility into unemployment, and therefore the picture is likely to be somewhat mixed, and (2) behavioral risk factors and health are likely to be strongly correlated. Therefore the direct role of health on transitions in and out of employment is difficult to disentangle from the indirect role of behavioral risk factors, as each may confound the other. Mirowsky and Ross ⁽⁵⁰⁾ have suggested that education enable people to integrate behaviors into a coherent life style. give them a sense of control over their health, and make them more able to pass on healthy habits to their family. Finding about the association of education with hearing loss in the current study express that hearing loss had a positive significant association with the illiterate persons (OR=2.88, CI=1.12-7.56); also it shows a significant association in those who are completed the secondary school grade (OR=2.09, CI=1.09-3.98). At the same time this table signify a protective relation with those who are completed a collage grade (OR=0.37, CI=0.16-0.82) . Barrenas et al ⁽⁵¹⁾, suggest an association between hearing loss and the educational level of the person., especially those illiterate persons. Hearing loss run in the families, some genetic components follow simple Mendelian principles of inheritance but others does not follow such principles and the influence of the genotype on the etiology of hearing loss may be attenuated or exacerbated by non- genetic factors. Several studies showed that the prevalence of hearing loss was significantly higher in subjects with a positive family history. Virginia Early Hearing Detection & Intervention Services (VEHDIS) ⁽⁵²⁾ established this relation. In the present study A

positive family history is found to be a significant risk factor in the development of hearing loss (O.R=4.97, C.I:1.35-18.25), about 12% of cases and 3 % of controls gives a positive family history of hearing loss. In this work, the association of other type II D.M with hearing loss showed to be significantly risky (OR=4, CI=1.08-14.79) while the other systemic diseases have no significant association. This result agreed with Hamer ⁽⁵³⁾, who find that there is a significant association between hearing loss and type II D.M. Other researches era in contrast with the other findings of present study. Fuortes et al ⁽⁵⁴⁾, were demonstrate a significant relation between hearing loss and some selected cardiovascular risk factors like HTN and history of ischemic heart disease, renal diseases and hypothyroidism. This association in the present study can be explained by many micro vascular complications as well as poly neuropathies that complicate type II D.M. The analysis of results regarding medication show a positive relation between hearing loss and those had past history of amino glycosides users (OR=8.61,CI=1.05-70.17), while there is no significant association between hearing loss and diuretics ,aspirin, NSAID and chemo therapy drugs with development of hearing loss. Govaerts et al⁽⁵⁵⁾ were demonstrate this relation . Other researchers in many studies were demonstrate the association between loop diuretics NSAID, aspirin and chemotherapy with development of hearing loss. This result of present study can explain by its dependence on dose-response relationship. Well-defined risk factors for amino glycoside-induced hearing loss have been established and include (1) presence of renal disease; (2) longer duration of therapy; (3) increased serum levels (either peak or trough levels); (4) advanced age; and (5) concomitant administration of other ototoxic drugs, particularly the loop diuretics⁽⁵⁵⁾.Noise carries a highly significant risk for development of hearing loss in adults (O.R=3.89,C.I:1.38-11.01). NIHL is now recognized as one of the most common occupationally induced disabilities, and as a result, noise exposure is now regulated by the Occupational Health and Safety Administration (OSHA). Hawkins ⁽⁵⁶⁾, explain this result as potential role of noise on mini vessels in the auditory part of the body that may lead to vaso constriction, which itself is the result of hearing impairment.

5 | CONCLUSION

Following conclusions can be drawn from this study .Age more than 45 years old was highly associated with development of hearing loss Regarding the gender ,males sex are more common than females sex in the distribution of cases of hearing loss in a ratio about 2:1 ; with a significant relation between gender and hearing loss .There is no significant association between the residence and hearing loss can be trapped in this study .In this work ,partially skilled occupations carried a high positive significant association with hearing loss ; while semi-professionals and unskilled occupations carried a significant protective association with hearing loss .Currently and passively cigarettes smokers appeared to have a risky association in contrast to former and non smokers .Family history was highly associated with occurrence of hearing loss if it is positive for close relatives. Among people in the sample study , those classified as type A personality appeared to have high risky association in the development of hearing loss in contrast to type B personality. The presence of life stressors appeared to play a significant risky role in the development of hearing loss. Illiterates and secondary level of education was a positive risk factor in the hearing loss. Furthermore, collage level of education appeared to be a protective factor in the natural history of hearing loss. The history of type II D.M observed to play a significant role in the occurrence of hearing loss. In this work , among the social context factors, only economical factors seem to had statistical difference between cases and controls and appear to promote the development of hearing loss.Amino glycoside drugs users where found to be significantly risky on hearing; other drugs which studied was not had such property. A significant association was found between excessive noise exposure and subsequent development of hearing loss.

6 | RECOMMENDATIONS

Hearing loss has become one of the major health problems in the Eastern Mediterranean region, and

and is associated with several etiological causes and risk factors. There is no strategy to prevent and control hearing loss in the health plans of most (if not all) the countries of the Eastern Mediterranean region. In addition, there is a great lack of quantitative and qualitative researches and studies on hearing loss. This creates the need for affective action, either to study factors contributing to the occurrence of hearing loss or to establish programs to control it. In order to achieve this, following recommendations should be considered:

I-General

1. Policy-makers should be aware of the importance and seriousness of the problem of hearing loss and its cost to the health care system budget.

2. There is a need for a national program to prevent and control hearing loss. A hearing loss control program should incorporate risk factors prevention (primordial, primary, secondary and tertiary) and etiological causes management as well as health education campaigns and training courses for health workers.

3. There is a need to include reliable information on prevention and management of hearing loss in school and university curricula.

4. Public health education that can be done through different communication media to inform the whole population about risk factors of hearing loss and co-morbidities associated with, from childhood to adult phase of life. Furthermore, the health education should put in the picture self-measurement of hearing loss parameters and encourage people to do periodically.

5. Effective hearing loss screening for individuals and groups at risk of developing hearing loss especially those with positive family history and old age involves a range of long-term strategies. This include hearing assessment and regular hearing test. They should be part of an integrated, multi-sectoral, population-based approach. Key elements include:

- Creating supportive population-based environment through public policies that prevent a load noise in the work stations and streets.
- Promoting healthy behaviors to encourage, motivate and enable individuals to protect their hearing.
- Mounting a clinical response to the existing burden of hearing loss and associated conditions through

clinical programs and staff training to ensure effective support for them.

- Provide education and training education professionals including physical education, health education and hearing service professionals, in State and local educational agencies.

- The key to the hearing loss prevention rests in the identification of modifiable risk factors toward which primordial prevention has directed, which is better to start from childhood.

6. It is important to encourage person (especially those at an increase risk) to seek medical advice if there is any complain in hearing.

7. Because of the limitation of this study, further studies especially large prospective ones as nested case-control or cohort studies, will further enhance and document the knowledge about the risk factors of hearing loss in the local community.

II- Specific:

1. Reduction of noise at sources by means of engineering (quieter machines) or acoustic (sound isolating) solutions as well as reduction of noise exposure time with obligatory hearing protection for employers in addition to establishing program for noise survey and education for employers.

2. Encourage a personal hearing protection in those areas where hearing protection use is required which include earplugs, earmuffs and active noise reduction (electronic method of sound attenuation).

3. Psychological counseling and support.

4. Early screening, diagnosis and management of type II DM.

5. Avoid drugs ototoxicity through adjustment the dosage and duration of treatment with ensure a good renal function prior to administer it, especially for amino glycosides and diuretics as well as administer of protective drugs (antioxidants) that protect from ototoxic and NIHL.

6. Avoid stress factors as much as possible and establishing of behavioral and psychological administrative therapies to overcome and antagonize these stressors.

7. Abstain smoking as soon as possible since it is a possible risk factor for hearing loss as well as advice people to avoid becoming a passive smoker.

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How to cite this article: Rabah Salih Mohammed Al. Ali et al. Hearing impairment determinants in adults, *Journal of Otolaryngology and Rhinology Research*. 2024; 214–225. <https://doi.org/10.52845/JORR/2024/5.2.2>