

RESEARCH ARTICLE

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The Impact of Cigarette Smoking, Water-Pipe Use on Hearing Loss/Hearing Impairment: A Cross-Sectional Study

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Abstract

Objective: The aim of the present study was to determine the association between cigarette smoking, waterpipe smoking, and co-morbidity diseases on hearing loss. **Methods:** A cross-sectional study was conducted among 1015 patients [386 males (38%) and 629 females (62%)] who were aged are between 25 and 65 years. The study used clinical, physical examinations and Pure-Tone Audiometry (PTA) to assess hearing. Univariate and multivariate stepwise logistic regression analyses were used for the statistical analysis. **Results:** Out of 1015 patients assessed, 199 were cigarette smokers with hearing loss (21.6%) and 111 waterpipe smokers with hearing loss (12%). There were statistically significant differences between cigarette smokers with hearing loss regarding (p<0.001), gender (p<0.001), BMI (p<0.001), hypertension (p<0.001), tinnitus (p<0.001), vertigo and/or dizziness (p<0.001), and migraine/headaches (p<0.001). Also there were statistically significant differences between waterpipe smokers with hearing loss, none smokers concerning age groups (p<0.001), BMI (p<0.001), using MP3 players (p=0.004), family history of hypertension (p=0.026), ATP III metabolic syndrome (p=0.010), IDF metabolic syndrome (p=0.012), tinnitus (p<0.001), vertigo/dizziness (p<0.001), and migraine/headaches (p=0.025). Multivariate stepwise logistic regression analysis indicated that tinnitus (p<0.001), dizziness (p<0.001), nausea (p=0.001), headaches and migraine (p<=0.003), fatigue (p=0.004), and vertigo (p=0.022) were considered as risk predictors risk hearing loss related cigarette smokers. Also, analysis revealed that tinnitus (p<0.001), nausea (p=0.001), headaches and migraines (p<0.001), Type 2 diabetes mellitus (p<0.001), and vertigo (p=0.021), were considered as risk predictors for hearing loss related waterpipe smokers. **Conclusion:** The present study suggests cigarette smoking and waterpipe smoking, life-style factors are possible risk factors for hearing loss among smoker participants.

Keywords: Epidemiology- Hearing impairment- smoking*Asian Pac J Cancer Prev*, 25 (1), 109-114

Introduction

Cigarette smoking is the most common global public health problem. Hearing loss is considered the 15th largest cause of the burden of disease according to the World Health Organisation (WHO) across gender and age groups [1]. Apart from systemic diseases caused by tobacco, it has been found that cigarette smoking affects the senses, which involves hearing [1-3]. Current smokers are at a higher risk for hearing loss compared to non-smokers [4-7]. The hearing system is greatly affected by cigarette smoking and the biomarker of exposure to tobacco in both active and passive smokers is cotinine (an alkaloid found in tobacco and the predominant metabolite of nicotine) [8, 9, 4-7].

Several studies have determined hearing loss and associated risk factors [10-13]. Several studies have also reported that hearing impairments are associated with

hypertension [14, 4, 12, 15], sleepiness [11], and cigarette smoking [6, 11, 16-18]. Moreover, using MP3 players have also become a serious risk factor for hearing loss [19, 20, 15].

The aim of the present study was to determine the association between cigarette smoking, waterpipe smoking, and co-morbid diseases on hearing loss.

Materials and Methods

Participants

A cross-sectional study was carried out comprising participants aged between 25 and 65 years who visited the Ear Nose and Throat (ENT) clinics and endocrinology clinics at the Istanbul Medipol University Hospitals between the period of May 2017 and March 2021. The sample size was based on previous reported prevalence

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[10] of impaired hearing among smokers 23%, assuming 99% confidence interval with 3% error of estimation [15]. The computed sample size was 1,250 participants. Overall, 1,250 individuals were approached, with 1015 agreed to participate in the study (response rate = 81%).

Ethics approval and consent to participate

All procedures executed in this study appropriately followed the declaration of Helsinki, 1964 (<https://www.wma.net/wp-content/uploads/2016/11/DoH-Oct2008.pdf>). Consent was obtained from all the respondents provided in the study. Ethical clearance was granted by the ethics committee and ethical approval (RP# 10840098-772.02.01-E.49746 and IRB# 10840098-604.01.01-E.3193). All individuals involved (or their caretakers) have signed the Free and Informed Consent Form.

Design

The study was based on a socio-demographic and clinical characteristics comparison of cigarette smoker patients with hearing loss versus cigarette smokers without hearing and non-smokers without hearing loss. Similarly, the socio-demographic and clinical characteristics comparison of waterpipe smoker patients with hearing loss versus waterpipe smoker without hearing loss compared to non-waterpipe smokers without hearing impairment.

Smoking history

Smoking data were determined in the same way for both smokers with hearing loss, smokers without hearing loss and compared with non-smokers and without hearing impairment. Smoking status was assessed as non-smoker and current smoker. The smoking group included patients that had a history cigarette smoking questions based on the items are: 1. At any time in your life, have you smoked 1 or more cigarettes per day for 30 days straight? 2. Do you currently use any of the following tobacco or nicotine products during the past 30 days? To assess the waterpipe smoking behaviour among participant, questions were included: Have you ever smoked tobacco from a waterpipe (shisha, nargile) and during the past 30 days. Patients from the non-smoking group had no history of smoking.

Hearing assessment

Pure-Tone Audiometry (PTA) was used to assess hearing sensitivity. The audiometric investigation was done to establish the type and the degree of the hearing impairment. PTA assesses the peripheral and central auditory systems. Two clinical digital audiometers (Garson Stadler GSI 61 and Interacoustics AC40 Clinical audiometer, Interacoustics, Assens, Denmark) were used for diagnosing hearing loss. They are regularly calibrated to international standards and the hearing level tests were performed by pre-trained technicians. The pure tone average is an indication of how well an individual can hear a normal conversation. Patients without hearing loss have a 0 to 26 dB loss. The hearing loss evaluation described and classified as follows: normal (≤ 26 dB) and hearing loss 26 dB above [10, 14, 15].

Statistical analysis

The Statistical Package for Social Sciences (SPSS, version 25) software was used to analyse the data. Significant differences between the means of continuous variables were calculated using t-tests. Chi-square test was performed to determine significant differences between categorical variables. One-way analysis of variance (ANOVA) was employed for comparison of several group means and to determine the presence of significant differences between group means. Multivariate stepwise logistic regression analysis was used to determine the predictor of risk factors for hearing loss with smokers. A level of $p < 0.05$ was used as the cut-off value for statistical significance.

Results

Out of 1015 patients, 199 were cigarette smokers with hearing loss (19.6%), and 111 were waterpipe smokers with hearing loss (10.9%). Table 1 present socio-demographic and clinical property of cigarette smoking patients with hearing loss and compared to the smokers without hearing loss and non-smokers with normal hearing. The majority of cigarette smoking patients with hearing loss were over 50 years old (54.8%) and female (61.5%). There were statistically significant differences between five groups included: cigarette smokers with hearing loss, cigarette smokers without hearing loss, none- Cigarette smokers without hearing loss, cigarette and waterpipe smokers with hearing loss, none-cigarette and none waterpipe smokers without hearing loss regarding ($p < 0.001$), gender ($p < 0.001$), BMI ($p < 0.001$), hypertension ($p < 0.001$), tinnitus ($p < 0.001$), vertigo and/or dizziness ($p < 0.001$), and migraine/headaches ($p < 0.001$).

Table 2 present the socio-demographic of the waterpipe smokers with hearing loss compared to waterpipe smokers without hearing loss and non-waterpipe smokers with normal hearing. Also there were statistically significant differences between five groups included: waterpipe smokers with hearing loss, waterpipe smokers without hearing, none-waterpipe smokers without hearing loss, cigarette and waterpipe smokers with hearing and none-cigarette and none waterpipe smokers without hearing loss concerning age groups ($p < 0.001$), BMI ($p < 0.001$), using MP3 players ($p = 0.004$), family history of hypertension ($p = 0.026$), ATP III metabolic syndrome ($p = 0.010$), IDF metabolic syndrome ($p = 0.012$), tinnitus ($p < 0.001$), vertigo/dizziness ($p < 0.001$), and migraine/headaches ($p = 0.025$). Table 3 shows Predictors of risks factors related hearing loss with cigarette smokers using Multivariate stepwise logistic regression analysis. The analysis indicated that tinnitus ($p < 0.001$), dizziness ($p < 0.001$), nausea ($p = 0.001$), headaches and migraine ($p < 0.003$), fatigue ($p = 0.004$), and vertigo ($p = 0.022$) were considered as risk predictors risk hearing loss related cigarette smokers.

Table 4 gives Predictors of risks factors related hearing loss with water-pipe nargileh smokers using Multivariate stepwise logistic regression analysis. The analysis indicated that tinnitus ($p < 0.001$), nausea ($p = 0.001$), headaches and migraines ($p < 0.001$), Type 2 diabetes mellitus ($p < 0.001$), and vertigo ($p = 0.021$), were

Table 1. The Socio-Demographic and Clinical Comparison of Cigarette Smoker Patients with Hearing Loss versus without (N= 1015)

Variables	Cigarette smokers with hearing loss ≥ 26 dB n=199	Cigarette smokers without hearing loss <26 dB n=94	None- Cigarette smokers without hearing loss <26 dB n=57	Cigarette & Waterpipe smokers with hearing loss ≥ 26 dB n=36	None- Cigarette & None Waterpipe smokers without hearing loss <26 dB n=629	p-value
Age groups in years						
< 40 years old	48 (24.1)	31 (33.0)	7 (12.3)	9 (25.0)	238 (37.8)	
40-50 years old	74 (37.2)	35 (37.2)	15 (26.3)	14 (38.9)	188 (29.9)	0.001
>50 years old	77 (38.7)	28 (29.8.0)	35 (61.4)	13 (36.1)	203 (32.3)	
Gender						
Males	67 (33.7)	33 (35.1)	31 (54.48)	12 (33.3)	243 (38.6)	0.001
Females	132 (66.7)	61 (64.9)	26 (45.6)	24 (66.7)	386 (61.4)	
Body mass index BMI						
Normal (kg/m ²)	48 (24.1)	12 (12.8)	10 (17.5)	5 (13.9)	232 (36.9)	
Overweight (kg/m ²)	64 (32.2)	31 (33.0)	37 (64.9)	20 (55.6)	242 (38.5)	0.001
Obese (kg/m ²)	87(43.7)	51 (54.3)	10 (17.5)	11 (30.6)	155 (24.6)	
Physical exercise (Yes)	54 (27.1)	29 (30.9)	10 (17.5)	11 (30.6)	219 (34.8)	0.38
MP3 player use (Yes)	162 (81.4)	83 (88.3)	57 (100.0)	26 (72.2)	503 (80.0)	0.32
Do you hear TV sounds (Yes)	169 (84.9)	85 (90.4)	52 (91.2)	30 (83.3)	549 (87.3)	0.539
Family history of hypertension (Yes)	52 (26.1)	17 (18.1)	10 (17.5)	2 (5.6)	91 (14.5)	0.001
Family of diabetes (Yes)	25 (12.6)	17 (16.1)	10 (17.5)	2 (5.6)	96 (15.3)	0.344
ATP III Metabolic syndrome(Yes)	23 (11.6)	8(8.5)	3 (5.3)	0 (0)	111 (17.6)	0.242
IDF Metabolic syndrome(Yes)	31 (15.6)	10 (10.6)	12 (21.1)	2 (5.6)	127 (20.2)	0.335
Tinnitus (Yes)	90 (45.2)	10 (10.6)	8 (14.1)	5 (13.9)	108 (17.2)	0.001
Vertigo and/or dizziness (Yes)	98 (49.2)	12 (12.8)	6 (10.6)	5 (13.9)	115 (18.3)	0.001
Migraine and headache (Yes)	116 (58.3)	28 (29.8.0)	12 (21.1)	11 (30.6)	127 (20.2)	0.001

Table 2. The Socio-Demographic and Clinical Comparison of Waterpipe Smoker Patients with Hearing Loss versus without (N= 1015)

Variables	Waterpipe smokers with hearing loss ≥ 26 dB n=111	Waterpipe smokers without hearing loss < 26 dB n=72	None- Waterpipe smokers without hearing loss < 26 dB n=31	Cigarette & Waterpipe smokers with hearing loss ≥ 26 dB n=36	None- Cigarette & None Waterpipe smokers without hearing loss < 26 dB n=765	p-value
Age groups in years						
< 40 Years old	26 (23.4)	20 (27.3)	4 (12.9)	9 (25.0)	274 (35.8)	
40-50 Years old	30 (27.0)	31 (43.1)	31 (77.4)	14 (28.9)	227 (29.7)	0.001
>50 Years old	55 (49.5)	21 (29.2)	3(9.7)	13 (36.1)	264 (34.5)	
Gender						
Males	43 (38.7)	18 (25.0)	10 (32.3)	15 (41.7)	300 (39.2)	0.177
Females	68 (61.3)	54 (75.0)	21 (67.7)	21 (58.3)	465(60.8)	
Body mass index BMI						
Normal (kg/m ²)	35 (31.5)	13 (18.1)	0 (0)	8 (22.2)	251 (32.8)	
Overweight (kg/m ²)	41 (36.9)	23 (31.9)	0 (0)	14 (38.9)	316 (41.3)	0.001
Obese (kg/m ²)	35(31.5)	30(50.0)	31 (100)	14 (38.9)	198 (25.9)	
Physical exercise (Yes)	28 (25.2)	21 (29.2)	9 (29.0)	15 (41.7)	250 (32.7)	0.35
MP3 player use (Yes)	95 (85.6)	51 (70.8)	30 (96.8)	26 (72.2)	639 (83.5)	0.004
Do you hear TV sounds (Yes)	169 (84.9)	85 (90.4)	52 (91.2)	30 (83.3)	549 (87.3)	0.539
Family history of hypertension (Yes)	26 (23.4)	11 (15.3)	0 (0)	6 (16.7)	114 (14.9)	0.026
Family of diabetes (Yes)	15 (13.5)	10 (13.9)	0 (0)	6 (16.7)	119 (15.6)	0.197
ATP III Metabolic syndrome(Yes)	17 (15.3)	6 (8.3)	0(0)	12 (33.3)	128 (16.7)	0.01
IDF Metabolic syndrome(Yes)	22 (19.8)	9 (12.5)	0(21.1)	10 (27.8)	155 (20.3)	0.012
Tinnitus (Yes)	74 (66.7)	13 (18.1)	5 (16.1)	15 (41.7)	613 (80.1)	0.001
Vertigo and/or dizziness (Yes)	63(56.8)	10(13.9)	1 (3.2)	11 (30.6)	159 (20.8)	0.001
Migraine and headache (Yes)	46 (41.4)	20 (27.8)	5 (16.1)	9 (25.0)	162 (21.2)	0.025

Table 3. Predictors of Risks Factors Related Hearing Loss with Cigarette Smokers Using Multivariate Stepwise Logistic Regression Analysis

Independent variables	Regression Coefficients	Standard Error	Odds Ratio	95 % Confidence	p-value
Tinnitus (Yes)	1.721	0.442	5.58	2.35 - 13. 28	0.001
Dizziness (Yes)	2.2	0.392	9.2	4.72 - 19.84	0.001
Nausea (Yes)	1.661	0.462	5.26	2.13 - 13.02	0.001
Headache and migraine	1.233	0.422	3.43	1.50 - 7.85	0.003
Fatigue (Yes)	0.987	0.342	2.68	1.37 - 5.24	0.004
Vertigo (Yes)	1.223	0.494	3.39	1.29 - 8.95	0.013

Table 4. Predictors of Risks Factors Related Hearing Loss with Waterpipe-Nargileh Smokers Using Multivariate Stepwise Logistic Regression Analysis

Independent variables	Regression Coefficients	Standard Error	Odds Ratio	95 % Confidence	p-value
Tinnitus (Yes)	1.237	0.274	3.445	2.01- 5.89	0.001
Nausea (Yes)	0.835	0.203	2.306	1.54 - 3.44	0.001
Headache and migraine	1.094	0.184	2.987	2.08 - 4.28	0.001
T2DM	1.088	0.215	2.968	1.957 - 4.52	0.001
Vertigo (Yes)	0.597	0.269	1.817	1.07 - 3.80	0.021

considered as risk predictors for hearing loss related waterpipe smokers.

Discussion

The results of previous studies have suggested that cigarette and waterpipe smoking are associated with hearing loss [8, 9, 4-7, 2, 15]. This is consistent with the results of the present study. Therefore, investigating the variables associated with smoking and hearing loss among the Turkish population is very important for hearing health prevention. Therefore, reducing smoking or stopping smoking completely may prevent hearing problems among individuals [8, 9, 4-7, 2, 15]. Hu et al. 2019 [4] reported that past smokers had lower risk of hearing loss than current smokers. More recently Bener et al. 2022 [15] reported relationship between cigarette smoking and hearing loss among chronic hypertensive patients which is confirmative with the current study.

The present study showed highly statistically significant associations between cigarette obesity, comorbidities, and hearing impairment among both cigarette and waterpipe smokers which concurs with previous studies [6, 10, 15]. Therefore, the present study showed similar results which are in consistent with previous studies regarding hypertension and tinnitus [1-4, 12, 15]. Furthermore, more recent studies have reported that hearing impairment is more common among patients with hypertension and diabetes compared to healthy subjects [13, 12, 15]. These results also concur with the present study.

The present study demonstrated strong positive relationship between obesity and being overweight and hearing loss. This concurs with earlier previous studies [18, 6, 15]. The use of MP3 players has become a very popular for listening to music [20, 21], this is confirmative with current study results outcome.

The present study has some limitations. Firstly,

because the data collection was so time consuming some of the participants did not want their audiometric data collected so they were excluded from the study (N = 183). Secondly, the information on smoking was collected by self-report which is subject to various methodological biases. Thirdly, the assessment of smoking habits status may be misclassified or may not be accurate (although, the cigarette smoking group included patients that had a history of more than 10 cigarettes a day). Fourth, the data concerning sleepiness obtained from the scale was subjective and may not be very precise.

In conclusion, the present study suggests cigarette smoking and waterpipe smoking, and lifestyle factors are possible risk factors for hearing loss among smoker participants.

Author Contribution Statement

Study design and conceptualization: AB, AE; Data curation and supervision: AB, AE; Project administration: AB, AE; Formal analysis and validation: AB, AE, MDG; Writing- original draft review & editing: AB, AE, MDG; Approval of final manuscript: AB, AE, MDG.

Acknowledgements

Ethical Approval and Consent to participate

All procedures executed in this study appropriately followed the declaration of Helsinki, 1964 (<https://www.wma.net/wp-content/uploads/2016/11/DoH-Oct2008.pdf>). Consent was obtained from all the respondents provided in the study. Ethical clearance was granted by the ethics committee and ethical approval (RP# 10840098-772.02.01-E.49746 and IRB# 10840098-604.01.01-E.3193).

Informed Consent

Written and verbal informed consent was obtained for the present study. All individuals involved (or their caretakers) have signed the Free and Informed Consent Form.

Availability of data and materials

The datasets generated are not publicly available but are available from the corresponding author request. The dataset analyzed in the current study was available from the corresponding author upon reasonable request.

Competing / Conflict of Interest

No conflict of interest was declared by the authors.

Financial Disclosure

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