ORIGINAL REPORT

Tinnitus: An Epidemiologic Study in Iranian Population

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Abstract- A wide range of population, 4% to 30%, suffers from tinnitus that is defined as perception of sound without apparent acoustic stimulus. We conducted the present study to determine the prevalence of tinnitus in Iranian population; Tehran province. This cross-sectional study was conducted from January 2009 to December 2009, recruiting 3207 individuals (age range, 7-98) who were residing in Tehran province, Iran. Participants were asked to fill two questionnaires; the validated Persian version of Tinnitus Questionnaire (TQ) and another one that was specifically designed for this study. Prevalence of tinnitus and its association factors were evaluated. 3207 participants enrolled into our study comprising 1429 (44.7%) male and 1765 (55.3%) female with mean age of 55.01±17.85. Of total of 3207 participants, 146 (4.6%) had tinnitus consisting of 80 male (54.8%) and 66 (45.2%) female participants. It showed a rising trend with increasing age that was especially significant after the sixth decade of life (*P*=0.001). The analysis showed mean TQ global score of 35.96±25.52 that was significantly different between male and female participants (*P*=0.051) and had no significant correlation with increasing age (Spearman's r=0.1, *P*=0.10). The tinnitus intensity was moderate to very severe in 95 (56.1%) of the participants. Its severity level was not significantly different between men and women (*P*=0.09). Tinnitus intensity had no significant association with increasing age (Spearman's r=0.1, *P*=0.31). Patients with higher TQ global score had higher tinnitus intensities (*P*=0.001). The annoyance level was significantly different between men and women (*P*=0.04) and its impact on the participants daily routine functions were significantly higher in men (*P*=0.003). Given the results of the study, demonstrating that prevalence of tinnitus in Iranian population (Tehran province) was lower than the other countries and had a direct correlation with increasing age only after the sixth decade. TQ global score had significant correlation with tinnitus intensity, annoyance and impact on the participants' daily routine functions. However, none of the above had correlation with increasing age. Tinnitus TQ global score and intensity were not different between men and women; however annoyance of tinnitus and its impact on participants' daily routine functions were significantly higher in men.

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Keywords: Prevalence; questionnaire; Tinnitus

Introduction

Tinnitus is a subjective perception of sound without apparent acoustic stimulus that could only be expressed by patients (1). Tinnitus has a wide range of reported prevalence from 4% to 30% due to epidemiological differences in various populations and different definitions, study methods and patient identifiers used (1-3). For instance using general health questionnaire, the reported prevalence in general population aged between 55 and 65 years-old was 20%; however, using more detailed tinnitus-specific questionnaires it was reported 11.8% (2,4). In addition, most of the studies were not community based and had only evaluated tinnitus among in-patients or out-patients referred to the different clinics (5,6).

Tinnitus could be treated or successfully coped with by many patients; however, up to 5% suffer from highly disabling tinnitus that could significantly affect many psychological and physical aspects of their health and

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reduce the quality of their life (7,8).

As there are few studies to estimate the prevalence of tinnitus and its burden in our region, and to find out its impact on individual`s routine life we conducted the present community based study. We intended to determine the prevalence of tinnitus in Tehran residents of Iranian population according to sex, and age as well identifying tinnitus questionnaire (TQ) global score and its components using validate Persian version of TQ (9,10). The impact of the tinnitus on daily routine function of the participants was also evaluated.

Materials and Methods

Study population

This cross-sectional study, conducted from January to December 2009, recruited 3207 individuals (age range, 7-98) who lived in Tehran province, Iran. Our target population consisted of people who lived in Tehran for the past ten years. A total of 140 clusters were randomly selected based on the postal codes using a computer-generated randomization table. For each cluster, a team of two trained interviewers (one male and one female) approached the index household, which is specified through the aforementioned random selection of clusters, and continued the enumeration in ten neighborhoods in a systematic manner by proceeding round in a clock-wise direction.

All participants older than the age of seven who had sound perceptions without external source which was lasting more than five minutes entered the study.

This study was approved by the Ethics Committee of the University.

Tinnitus assessment

Participants were asked to fill in the questionnaire; validated Persian version of TQ (9,10). TQ is a 52 item self-rating scale that was originally developed by Hallam (9) and assesses six accompanied complaints including emotional and cognitive distress, intrusiveness, auditory perception, sleep disturbance and somatic complaints. TQ global score was calculated via feeding the score of each item to the related software. In this study, we used Persian version of TQ that was validate by Farhadi *et al.* (10) through achieving an accurate internal consistency (Cronbach's alpha=0.91-0.95).

Furthermore, tinnitus severity, duration, intensity and location as well its impact on daily routine function and any seeking for medical help were asked and recorded.

Statistical analysis

Data are presented as number (%) and means±standard deviation. The univariate analyses of the continuous and categorical variables were carried out using Student's t-tests and chi-squared test. An analysis of linear regression and the coefficient of linear correlation of Pearson were used to show the correlation between the TQ score and age. A *P*-value of equal or less than 0.05 was considered significant. Statistical analysis was performed using SPSS 16 for Windows.

Results

A total of 3207 participants with mean age of 55.01±17.85 enrolled into the study including 1429 (44.7%) male and 1765 (55.3%) female. Mean age was slightly but not significantly higher in men than in women (55.11±17.41 vs. 54.89±18.51, *P*=0.90).

Tinnitus prevalence

Among 3207, 146 (4.6%) had tinnitus comprising 80 male (54.8%) and 66 female (45.2%) participants. Mean age was 55.06±17.69 in these 146 patients; 54.59±17.85 in men and 55.81±17.74 in women which was not considerably different (*P*=0.785) (Table 1). Tinnitus had a rising prevalence with increasing age and their association was significant after the sixth decade of life (*P*=0.001).

Table 1. TQ global score and its components according to the gender.

Characteristic	Male	Female	*P*-value
TQ global score	31.41±25.97	43.85±23.35	0.051
Emotional distress	34.15±28.95	45.60±24.81	0.09
Cognitive distress	25.87±28.37	37.02±28.77	0.12
Emotional and cognitive distress	30.64±2.74	40.63±2.56	0.14
Intrusiveness	35.87±27.99	47.14±23.05	0.09
Auditory perception	55.31±28.28	64.64±26.16	0.23
Sleep disturbance	38.75±30.59	51.66±30.20	0.22
Somatic compliant	51.51±27.65	50.77±25.02	0.93

Data are presented as Mean±standard deviation (SD). TQ, Tinnitus questionnaire

Table 2. TQ global score and its components according to the tinnitus location.

Characteristic	Right ear	Left ear	head	Both ear	Head and ears
TQ global score	38.13±2.4	36.77±2.67	45.27±2.87	31.46±2.80	29.39±2.43

Data are presented as Mean±standard deviation (SD). TQ, Tinnitus questionnaire

TQ global score

The analysis showed mean TQ global score of 35.96±25.52; 31.41±25.97 in male and 43.85±23.35 in female participants which was not significantly different (*P*=0.051). None of TQ components were significantly different between male and female cases (Table 1). As well, TQ global score did not show any significant correlation with increasing age (Spearman's Rank correlation coefficient r=0.1, *P*=0.10). Highest and lowest means of TQ components belonged to the auditory perception (58.70±3.73) and cognitive distress (30.07±3.47).

Tinnitus intensity

Tinnitus intensity was trivial in 21 (14.4%), mild in 30 (20.5%), moderate in 52 (35.6%), severe in 40 (27.4%) and very severe in 3 (2.1%) participants with tinnitus. Mann-Whitney U-test showed that tinnitus intensity was not significantly different between male and female participants (*P*=0.09). Tinnitus intensity had no significant association with increasing age (Spearman's Rank correlation coefficient r=0.1, *P*=0.31). Tinnitus intensity had an increasing pattern in 54 (24%) and a decreasing one in 32 (14.2%) participants. Patients with higher tinnitus intensity had higher TQ global score (Spearman's Rank correlation coefficient r=0.51, *P*=0.001).

Tinnitus annoyance

Of 146 tinnitus cases, 25 (17.1%) stated that it was not bothersome; however, it was considered to be mildly bothering in 41 (28.1%), moderately in 41 (28.1%), severely in 23 (15.8%) and very severely in 16 (11%) cases (Table 4). There was no significant correlation between tinnitus annoyance and age (Spearman's Rank correlation coefficient r=0.1, *P*=0.12). Mann-Whitney U-test showed that tinnitus annoyance was different between men and women (*P*=0.04). Patients with higher tinnitus intensity had higher TQ global score (Spearman's Rank correlation coefficient r=0.64, *P*=0.001).

Tinnitus impact on the patient's daily routine function

Tinnitus had no impact on the daily routine functions of 64 (43.8%) subjects; however, others stated that it had some degree of impact on their function; mild impact in 30 (20.5%), moderate in 40 (27.4%) and severe impact in 12 (8.2%) cases. The reported impact was significantly higher in men than in women (*P*=0.003). Impact of tinnitus on the routine function of cases had no significant association with their age (Spearman's Rank correlation coefficient r=0.01, *P*=0.89). Patients with higher TQ global score showed significant association between tinnitus impact and patient's routine function (Spearman's Rank correlation coefficient r=0.64, *P*=0.001).

Tinnitus location

Among 146 cases, tinnitus perception was reported in the right ear in 42 (32.2%), in the left ear in 30 (20.5%), in both ears in 48 (32.9%), in the head in 9 (6.2%) and in the head and both ears in 12 (8.2%) participants. Mann-Whitney U-test showed that tinnitus location was not different between men and women (*P*=0.43).

There was no significant correlation between TQ global score and its components and tinnitus locations (Table 2).

Tinnitus location had no significant correlation with tinnitus intensity, annoyance and impact on the daily routine function (Fischer's exact test *P*=0.41, *P*=0.67 and *P*=0.061, respectively) (Tables 3, 4 and 5).

Out of 146 participants with tinnitus, 132 (90.4%) cases sought for medical advice; 84 (63.3%) from a general physician and 48 (36.3%) from an otolaryngologist. For 71 subjects (53.7%), medication had been administered. Seeking medical advice and administration of medication were not significantly different between men and women (*P*=0.51 and *P*=0.85, respectively).

Insomnia was reported in 92 of 146 cases (41.1%) with tinnitus and 88 of 127 (62%) of patients who complained that their function were somehow affected from tinnitus had insomnia that revealed the significant correlation between insomnia and decreased daily routine function in cases with tinnitus (*P*=0.745, *P*<0.001). Hyperechosia and phono-phobia were the two common concurrent complications seen with tinnitus (50.6% and 42.4% respectively).

Table 3. Tinnitus intensity according to the tinnitus location.

Location	Intensity					Total
	Trivial	Mild	Moderate	Severe	Very severe	
Right ear	3 (13.6%)	6 (27.3%)	6 (27.3%)	6 (27.3%)	1 (4.5%)	22
Left ear	1 (7.1%)	2 (14.3%)	7 (50.0%)	4 (28.6%)	0	14
Head	0	1 (16.7%)	2 (33.3%)	3 (50.0%)	0	6
Both ears	2 (9.5%)	9 (42.9%)	7 (33.3%)	3 (14.3%)	0	21
Head and both ears	0	0	3 (75.0%)	0	1 (25.0%)	4

Data are presented as n (%).

Table 4. Tinnitus Annoyance according to the tinnitus location.

Location	Annoyance					Total
	Not annoying	Mild	Moderate	Severe	Intolerable	
Right ear	2 (9.1%)	7 (31.8%)	5 (22.7%)	5 (22.7%)	3 (4.5%)	22
Left ear	2 (14.3%)	7 (50%)	2 (14.3%)	2 (14.3%)	1 (7.1%)	14
Head	1 (16.7%)	0	3 (50%)	1 (16.7%)	1 (16.7%)	6
Both ears	5 (23.8%)	6 (28.6%)	7 (33.3%)	1 (4.8%)	2 (9.5%)	21
Head and both ears	1 (25.0%)	1 (25.0%)	1 (25.0%)	1 (25.0%)	0	4

Data are presented as n (%).

Table 5. Tinnitus impact on routine function according to the tinnitus location.

Location	Impact on routine function					Total
	Not annoying	Mild	Moderate	severe	Intolerable	
Right ear	10 (45.5%)	7 (31.8%)	4 (18.2%)	1 (4.5%)	0	22
Left ear	9 (64.3%)	3 (21.4%)	0	1 (7.1%)	1 (7.1%)	14
Head	0	1 (16.7%)	4 (66.7%)	1 (16.7%)	0	6
Both ears	11 (55%)	2 (20%)	2 (20%)	1 (5%)	0	21
Head and both ears	1 (25.0%)	1 (25.0%)	2 (50%)	0	0	4

Data are presented as n (%).

Discussion

The present community based study revealed a prevalence of 4.6% for tinnitus in Iranian population that was 6.4% and 14.6% in those within the sixth and seventh decades of age and 16.8% in patient more than 70 years-old. These numbers are considerably low when compared to other communities which could be due to the wide age range of the subjects from 7 to 98 (11-14). The prevalence of tinnitus in American elderly of sixth and seventh decades was reported 10.1% and 8.7%, respectively (11). These rates were 32.7% and 30.5%, respectively in an Australian community based study (12). Another epidemiologic investigation for tinnitus in Korea revealed that the overall prevalence of tinnitus was 20.27%, that is very higher than our results but they also stated that tinnitus prevalence had a significant tendency to increase after the age of 60 which agrees with our findings (13). There is another study from Japan whose results were the same as ours. They reported that tinnitus occurred in 112.9% of adults between ages of 45 and 79 and revealed that its prevalence increased with increasing age in both sex groups (14). However, it is in contrast with Hoffman and Reed (15) study that compared 6 different studies to obtain age-specific tinnitus prevalence in adults. They reported an increasing pattern for tinnitus prevalence with increasing age up to the sixth decade of life when it reached a plateau either in the sixth and seventh decades and subsequently declined in the higher age groups.

Despite the large volume of epidemiological work on tinnitus, there are still a lot of controversies regarding

this matter. For instance, some state that the age-related tinnitus exists as a separate pathology and is related to the degeneration of auditory system on different levels; however, others suggest that the pathophysiology of tinnitus and its prevalence in old age is the same as tinnitus in younger people (16,17). Some have discussed that the rising prevalence of tinnitus in old age does not necessarily mean that tinnitus will increase with the age as a split symptom (15).

Regarding tinnitus in different genders, our study revealed that tinnitus was slightly more prevalent in men than women [80 (54.8%) vs. 66 (45.2%)] but its intensity was not significantly different between men and women (Mann-Whitney U-test, P=0.09). There are several controversial beliefs regarding the effect of gender on the prevalence of tinnitus. Like us, some, such as Fujii *et al*. (14) showing slightly higher percentage of tinnitus in men (13.2% vs. 10.7%), suggest that its prevalence is higher in that gender (14,18,19). However, our findings are not in accordance with Hasson *et al.* (20) study of Swedish population that showed nearly two-fold risk of tinnitus in men than in women (10% vs. 5%). A possible reason for this trend could be the higher exposure of men to industrial noises (16,21). On the other hand, there had also been a few studies that have described a slightly higher prevalence of tinnitus in women (13). As women generally have more time to look for medical care, there may be more women participating in surveys and studies which could be considered as a selection bias and explains higher prevalence of tinnitus in women in some studies (13,16,22). Furthermore, as depression has a higher prevalence among females either a close relationship with tinnitus, some stated that it could affect the higher prevalence and bothersome of tinnitus in the women (23,24).

According to our results, routine functions have been moderately to severely affected in 35.6% of the participants (7.5% and 20.3%, respectively) and it was more significant in male participants which is comparable with other studies that revealed about 20% of their cases had complained from their tinnitus symptoms(1,13,25). Pinto *et al.* (1), Coelho *et al*. (26) and Davis *et al.* (25) found that females gave significantly higher frustration compared to the males from tinnitus that is in contrast with our findings.

We did not assess the quality of life in these participants and just evaluated their subjective perception of their daily routine functions that were affected by tinnitus. Evaluating the effects of tinnitus on quality of life, due to various covariates, is a complex issue and its confounders and different aspects that require specific questionnaires to be identified were not the priority of the present study. Instead, we used TQ score which allowed us to consider heterogeneous dimensions that could be associated with tinnitus such as emotional distress, negative and dysfunctional cognition aspects of intrusive nature of noises or associated hearing deficiencies. The analysis showed that neither the TQ global score nor its components were significantly different between men and women (Table 2). TQ global score as well, had no significant correlation with increasing age (Spearman's r=0.10).

We detected insomnia in about 41% of patients with tinnitus that is comparable with previous works which reported it at about 25-60% and claimed it to be among the three major complaints of the patients (1,27-29). As well, we found that insomnia was significantly common among subjects with tinnitus and it is more prevalent among those complaining of functional losses, which suggested that this sleep disturbance could exert profound negative effects on their function.

In conclusion, the study demonstrated that the prevalence of tinnitus in Iranian population (Tehran province) is lower than others and only after the sixth decade of life, had a direct correlation with increasing age TQ global score had a significant correlation with tinnitus intensity, annoyance and impact on the participants' routine daily functions. None of them had a relationship with increasing age. Tinnitus TQ global score and intensity were not different between men and women; however its annoyance and impact on the participants' routine functions were significantly higher in men.

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