

Prevalence and Risk Factors of Tinnitus Among University Students

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Abstract

Objective: The purpose of this study was to investigate the prevalence of tinnitus and other associated risk factors among students from the University of Jordan.

Methods and Design: This cross-sectional study included 1,302 students (785 females and 517 males; aged 17–30 years old) attending the University of Jordan. All participants completed a tinnitus survey that included questions concerning the presence of tinnitus and its characteristics, exposure to recreational noise, and smoking habits. Tinnitus discomfort was measured using an Arabic Visual Analogue Scale (VAS). Descriptive and inferential statistics were used to analyze the data.

Results: The overall prevalence of tinnitus (continuous or intermittent) was 21.2% among participants, with females having 13.9% prevalence and males having 7.3%. Pearson's Chi-square test revealed a significant association between tinnitus and the influence of the various risk factors ($\chi^2=102.09$, $df=4$, $p<0.001$). In addition, tinnitus was more likely to be associated with noise exposure (29%) and smoking (15%), and less likely to be related to seasonal allergies and gender. The results of the VAS indicated that only 5% of the students reported that their tinnitus was extremely uncomfortable.

Conclusion: According to the findings of this study, the prevalence of tinnitus among university students who participated in this study was 21.2%. Furthermore, our results showed that exposure to recreational noise and smoking were associated with the presence of tinnitus.

Keywords: Tinnitus, leisure noise, students, risk factor, prevalence

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INTRODUCTION

Tinnitus is defined as an auditory phantom sensation (ringing in the ears) experienced by the patient when there is no real external sound stimulus present [1]. Tinnitus is classified into two categories: subjective and objective. Subjective tinnitus, or tinnitus experienced only

by the patient, is considered more standard. Objective tinnitus is deemed less common and can be heard by both the patient and the examiner [2].

Most people experience tinnitus at some point in their lives. However, it is typically associated with a reversible cause such as attending a noisy event, having a fever, or taking certain medications. Although the sensation of tinnitus typically subsides over a period ranging from seconds to days [1], it is unremitting [3] in 5–15% of the general population. Tinnitus is estimated to reduce the quality of life of 1–2% of the general population [4].

Several underlying causes of tinnitus have been discussed in the literature, including high

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calcium intake, spontaneous otoacoustic emissions, and inner ear damage [5]. In addition, recreational noise exposure [6], drug-induced tinnitus [7], and dietary supplements [8] are all among the reported causes of tinnitus.

Tinnitus is commonly associated with hearing loss. However, this disturbing condition is not restricted to hearing-impaired patients and also affects people with normal hearing. The spectrum of hearing loss corresponds to the perceived tinnitus spectrum, and both noise-induced hearing loss and age-related (presbycusis) hearing loss are considered serious risk factors for tinnitus [9]. The facts presented thus far suggest a synchronizing relationship between hearing loss and the onset of tinnitus. Nevertheless, this diverges from studies revealing that many normal-hearing individuals suffer from tinnitus and that many patients with age-related hearing loss or noise-induced hearing loss do not develop tinnitus [10].

The perception of tinnitus and its characteristics have been reported to differ in the presence of hearing loss. Participants with hearing loss have greater levels of tinnitus loudness, maskability, and subjective discomfort than participants with normal hearing. The severity of the symptoms is perceived to be increased as a result of these reported characteristics [11].

Because most individuals with ear-related problems do not seek treatment, community-based studies with high response rates are vital for determining the true prevalence of tinnitus [12]. Moreover, since tinnitus is usually associated with age-related hearing loss, most studies on tinnitus prevalence focused on older adults rather than young adults, such as university students. Young adults are exposed to loud sounds through recreational activities such as personal listening devices, parties, nightclubs, discotheques, and concerts [13].

Tinnitus prevalence varies according to published literature. Tinnitus affects between 1.4 and 9.8% of young adults aged 20–29 years [14]. The overall prevalence of tinnitus in Egypt is reported to be 5.17%, of which 2.35% are between 6–19 years old.

There are very few studies in the literature that have investigated the prevalence of tinnitus in Middle Eastern communities, especially among university students [15]. Additionally, even though young adults are more exposed to recreational noise than older adults, few studies have been conducted to assess the prevalence and risk factors of tinnitus in this population.

The overall aim of this cross-sectional study is to determine the prevalence and risk factors associated with tinnitus among students attending the University of Jordan.

METHODS AND DESIGN

Participants

Data were collected at the University of Jordan in Amman over five months from November 2018 to March 2019. According to the inclusion and exclusion criteria, a total of 1,302 participants were included (517 males and 785 females aged 17–30 years old). The inclusion and exclusion criteria were as follows:

- Participants were included in the study if they were between 17–30 years old, which is representative of the young adult population. Participants were also included if they reported normal hearing sensitivity and were University of Jordan students.

- Participants were excluded if they reported a hearing impairment, a recent history of ear disease, or if they suffered from any psychological issues, mental or neurological disorders, in addition to any systemic diseases such as diabetes, cardiac diseases, and vascular anomalies.

- An otolaryngologist (or a clinical audiologist) briefly interviewed each participant to evaluate the abovementioned criteria.

Materials and Participant Assessment

The authors designed a simple questionnaire to investigate the prevalence of tinnitus and its risk factors. The questionnaire comprised of 12 items divided into four sections. The first section asked about the participants' age and gender. The second section included questions about tinnitus risk factors such as smoking, noise exposure, and seasonal allergies. Participants were asked if they were regularly exposed to recreational noise, such as listening to loud music through earphones or

attending concerts. The third section contained information concerning the presence of tinnitus and its characteristics, whether it was intermittent or persistent, and whether it was experienced unilaterally or bilaterally. If the tinnitus was experienced unilaterally, participants were asked if it was in the left or right ear. Tinnitus was defined as any sound heard in either ear for more than six months and lasting each time for a duration >5 minutes.

The final section included a simple Arabic Visual Analogue Scale (VAS) to assess subjective discomfort, adapted from Savastano [11] and Raj-Koziak et al. [16]. They reported that the VAS was valid and reliable for screening purposes. The VAS aimed to document the tinnitus discomfort level by asking the participants to choose a number between 0 and 10 (where 10 was the most uncomfortable and 0 was the least uncomfortable). These levels of discomfort were divided into three types: 0–2: slight; 3–6: moderate; and 7–10: elevated.

Statistical Analysis

The results were analyzed using SPSS software v23 for Windows. Levene's test of the equality of variance was significant (<0.05),

revealing that non-parametric tests should be performed. The data were analyzed using the Binominal Logistic Regression test and Pearson's Chi-Square test of correlation between tinnitus and various risk factors. The significance level was set at $p < 0.05$ (5%), with 95% confidence intervals.

Ethical Consideration

Ethical approval was obtained by the Jordan University Hospital's Institutional Review Board (IRB) under the University of Jordan Ethics Framework. Furthermore, all volunteers gave verbal consent.

RESULTS

A total of 1,302 students from the University of Jordan participated in this study. The mean age of the participants was 21.37 years $\pm$ 2.21 (SD). None of the participants reported any history of an ear-related disease. Table 1 shows the sample distribution and classifies the primary cohort based on the study questions. It also shows the relationship between the risk factors and the presence of tinnitus. The Kruskal-Wallis and X^2 tests revealed a significant difference between tinnitus and risk factors.

Table 1 : Relationship between the Risk Factors and the Presence of Tinnitus

Variables	Total sample (n=1302)	Tinnitus			Kruskal-Wallis	
		No tinnitus	Intermittent	Continuous	Test statistic	p
Age mean (SD)	21.37 (2.2)	21.46 (2.2)	20.80 (1.9)	22.04 (2.6)		
Gender % (n)					$X^2=4.088$	0.43
Male	39.8 (517)	32.5 (422)	5 (65)	2.3 (30)		
Female	60.2 (783)	46.3 (602)	12 (156)	1.9 (25)		
Smoking % (n)					$X^2=28.7$	0.001
Yes	17.9 (234)	11.8 (154)	4.2 (55)	1.9 (25)		
No	82 (1066)	66.9 (870)	12.8 (166)	2.3 (30)		
Noise exposure % (n)					$X^2=140.07$	0.001
Yes	14.2 (185)	6.5 (85)	5.7 (74)	2 (26)		
No	85.8 (1114)	72.3 (939)	11.2 (146)	2.2 (29)		
Spring Allergies % (n)					$X^2=7.82$	0.005
Yes	36.6 (476)	27.3 (355)	7.2 (94)	2.1 (27)		
No	63.4 (824)	51.5 (669)	9.8 (127)	2.2 (28)		

Pearson's Chi-square test revealed a significant association between tinnitus and the influence of the various risk factors ($\chi^2=102.09$, $df=4$, $p<0.001$). In addition,

tinnitus was found to be more likely associated with noise exposure and smoking, and less likely to be related to seasonal allergies and gender (Figure 1).

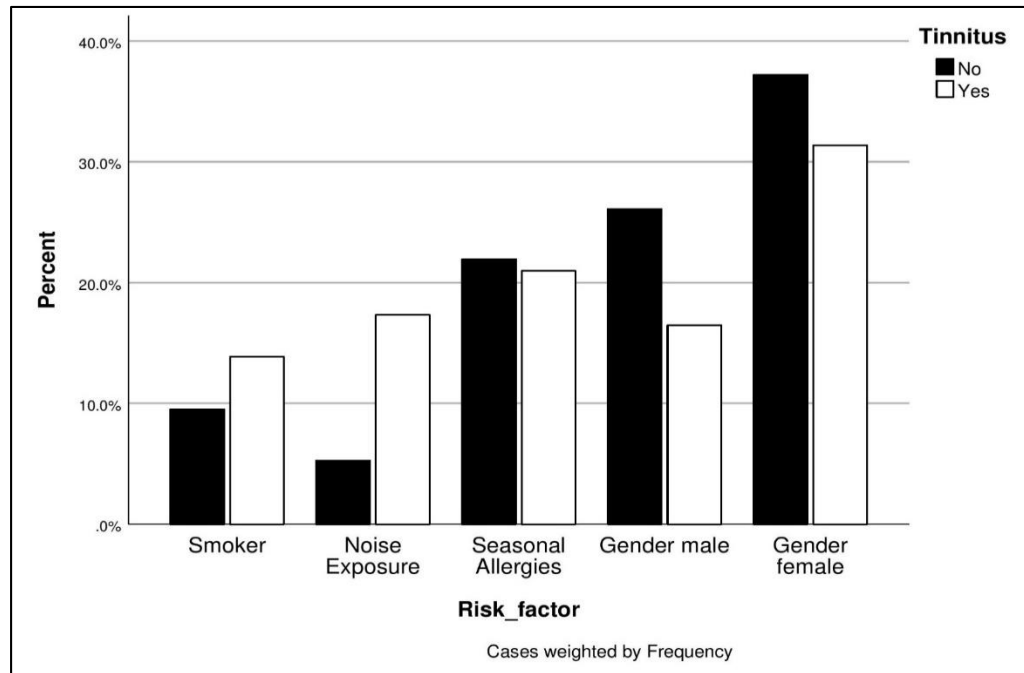


Figure 1 Percentage of Participants Reporting Tinnitus v no Tinnitus and the Association of the Risk Factors and Gender

The gender distribution of risk factors was investigated further. A greater percentage of females than males reported having tinnitus. Spring allergies were reported by 36.6% of the sample, with more females reporting than males. 17.9% of the sample were smokers, with male smokers outnumbering females. Noise exposure was reported by 14.2% of participants, with females reporting greater exposure to noise than males.

The Chi-square test showed a significant association between gender and the influence of various risk factors ($\chi^2=99.35$, $df=3$, $p<0.001$). Females were more likely to report seasonal allergies and noise exposure, and were less likely to be smokers.

Binomial logistic regression was performed to ascertain the effect of gender and the risk factors of smoking, noise exposure, and spring allergies on the likelihood of having tinnitus.

Using the conditional backward elimination model, the final regression model indicated that the regression model was statistically significant at <0.05 . The model explained 31.6% (Nagelkerke R^2) of the variance in tinnitus and correctly classified 77.5% of the cases.

According to the findings, 276 (21.1%) of the students reported tinnitus, of whom 95 (34.4%) were males and 181 (65.6%) were females. Some 24 (8.7%) participants reported tinnitus in the left ear, 105 (38.0%) reported tinnitus in the right ear, and 147 (53.3%) experienced tinnitus bilaterally. In terms of the nature of tinnitus, 55 (19.9%) reported continuous tinnitus, while 221 (80.1%) reported intermittent tinnitus. Figure 2 depicts the gender distribution of the nature of tinnitus, with 30.7% of males reporting continuous bilateral tinnitus compared to 18.2% of females.

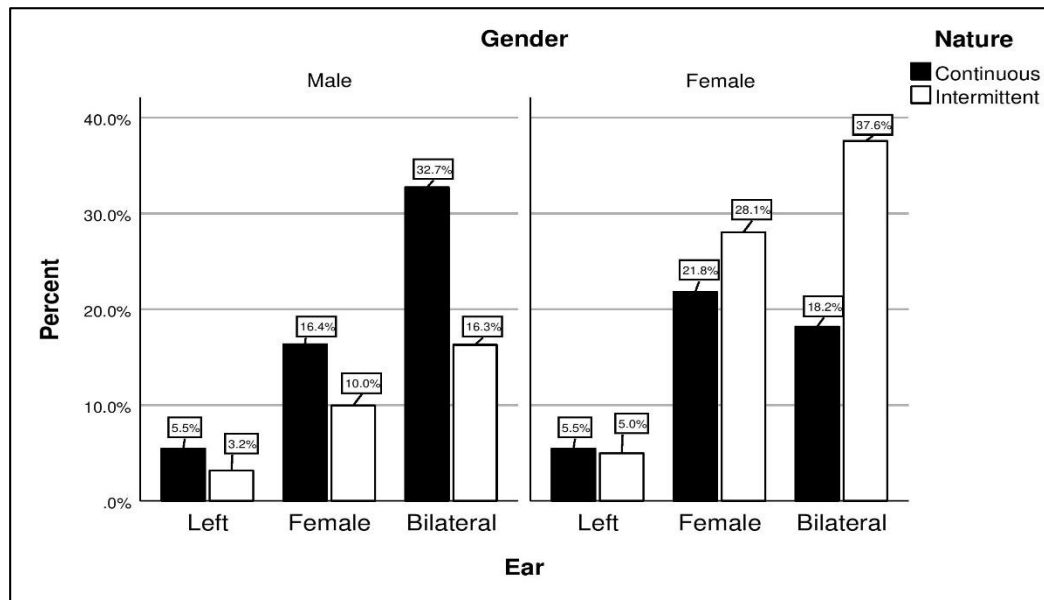


Figure 2: Distribution of Participants Reporting Tinnitus based on its Nature

Participants who reported having tinnitus used a VAS to rate their level of discomfort on a scale of 1 to 10. Some 21.9% of participants reported subjective tinnitus discomfort between one and two on the VAS (slight), and 62% indicated tinnitus discomfort between three and six on the VAS (moderate), suggesting that

tinnitus was not considered uncomfortable by young adults. Around 16.1 % of participants rated tinnitus in both forms (continuous and intermittent) as 7–10 on the VAS, with ten being the most uncomfortable (elevated). The graph shows that female participants reported more discomfort than males.

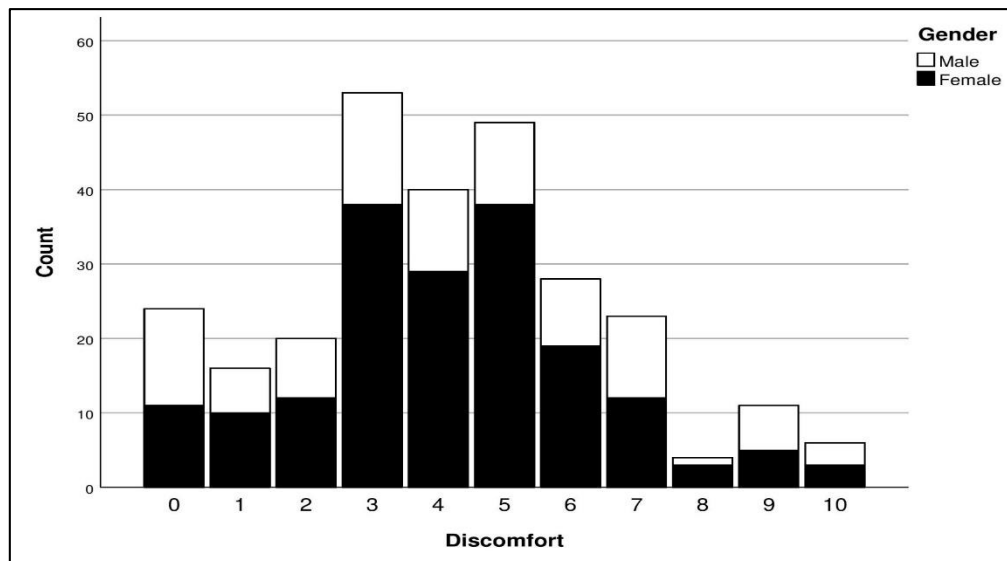


Figure 3: Participants' Ratings for Discomfort Level on the Visual Analogue Scale (10 = most uncomfortable and 0 = Least Uncomfortable)

The results revealed that 185 participants reported being regularly exposed to noise, with 100 (54.0%) reporting tinnitus. A Chi-square test was performed to explore the association between tinnitus and noise exposure. The results showed a statistically significant association between tinnitus and noise exposure, $p < 0.05$ on the one hand and smoking on the other ($p < 0.05$). Out of the 276 participants reporting tinnitus, 85 (34.6%) were smokers.

Binomial logistic regression was performed to ascertain the likelihood of having tinnitus and its association with gender, smoking, noise exposure, and spring allergies. Using the conditional backward elimination model, the final regression model indicated that the regression model was statistically significant at < 0.05 . The model explained 16% (Nagelkerke R^2) of the variance in tinnitus and correctly classified 79.6% of the cases.

DISCUSSION

The current study targeted university students aged between 17 and 30 years who appeared to have normal hearing. This cohort was chosen due to the lack of studies in the literature conducted on such populations [17–19]. In addition, most previous articles studying the prevalence of tinnitus were conducted on the general population rather than age-specific groups.

According to the current study, the overall prevalence of tinnitus in university students aged 17–30 was 21.2%. According to the results, females reported experiencing tinnitus more frequently than males (64.3% female participants vs. 35.7% male participants). This was statistically significant, indicating an association between tinnitus and gender. The gender difference in the prevalence of tinnitus is inconsistent with previous studies [19–22].

A previous study that used the Tinnitus Functional Index (TFI) questionnaire to measure tinnitus severity reported that 3 (out of 34) of the normal hearing participants reported severe annoyance of tinnitus compared to 16 (out of 39) of the participants with hearing loss [23]. This result is comparable to the 5% of

participants in the current study who reported tinnitus to be the most uncomfortable on the VAS (reporting a 10 on the scale). The current study's findings are consistent with the TFI questionnaire's findings, confirming that participants with normal hearing tend to report tinnitus to be less annoying than participants with hearing loss.

As previously mentioned, the overall prevalence of tinnitus in the targeted cohort was 21.2% (17% intermittent, 4.2% persistent). Few studies investigating the prevalence of tinnitus in comparable cohorts were found in the literature; Bhatt (2018) reported a similar rate (21.4%) to what was found in the current study. On the other hand, two other studies found different prevalence rates: 6.6% [21] and 12% [6]. Therefore, a broader search was conducted to look at studies investigating the prevalence of tinnitus in the general population. The results of similar age groups were compared to current research. In Korea, the prevalence rate was 14.6% [22], while it was 5.7% in the United Kingdom [19], 9.8% in Norway [17], and 7.5% in Sweden [18]. The discrepancies in tinnitus prevalence rates could be attributed to differences in the definition and characteristics of tinnitus that influence participant selection and inclusion.

The current study investigated the effect of smoking on tinnitus. We found 17.9% of participants to be smokers, which is lower than the 35% reported previously among Jordan University students [25]. This difference in prevalence could be attributed to the fact that the population of this study consisted primarily of medical school students. Results indicated that 27.1% of tinnitus sufferers smoked, which was statistically significant based on the Chi-square ($p < 0.05$). This is consistent with the results of a meta-analysis conducted by Veile et al. [26], which showed a statistically significant association between smoking and tinnitus. However, Oiticica and Bittar [21] reported no statistically significant difference in tinnitus development between smokers and non-smokers.

The results revealed that 185 (14.2%) of all participants had been regularly exposed to

leisure noise, of whom 100 (54.0%) reported tinnitus. The association between tinnitus and noise exposure was tested with the Chi-square, and a statistically significant association was found ($p < 0.05$).

The correlation between tinnitus and leisure noise is of great concern, as the number of young adults attending events with high levels of noise is increasing [27]. It is evident in the literature that there is a strong correlation between noise exposure and tinnitus [20, 28–31]. Themann and Masterson [32] reported that the prevalence of tinnitus among individuals exposed to leisure noise was 17.1% vs. 7.4% in those not exposed. Gilles et al. [30] reported that 89.5% of the participants exposed to leisure noise experienced temporary tinnitus, while 14.8% experienced irreversible tinnitus. A study conducted in Canada to investigate the prevalence of tinnitus in young adults (aged 19–29 years) found that 80% of the target population was exposed to recreational noise, with 37% developing tinnitus after the exposure [31]. Bhatt [24] found that 23.8% of his study's participants experienced tinnitus after exposure to loud music.

The current study found 36.6% of participants had seasonal allergies, which is consistent with the prevalence of seasonal allergies in Jordan and is associated with exposure to pollen from olive trees [33]. The current study showed that seasonal allergies did not significantly affect tinnitus. Contrary to this finding, Cho and Park [34] reported that allergic rhinitis and tinnitus had a significant effect in Korea. However, this study was a South Korean population study that included a wider age group than the current investigation.

Study Limitations and Future Research

The purpose of this was to investigate the

overall presence of tinnitus in a young population with apparently normal hearing. Despite the large number of respondents in the current study, it is limited to students attending the University of Jordan. Future research could be enhanced by testing a more comprehensive range of young adults in Jordan's governorates. Future research into the VAS and its association with tinnitus function index surveys is advised. A hearing screening test to ensure that the participants' hearing levels in the study are within normal thresholds could be beneficial.

CONCLUSION AND RECOMMENDATIONS

We identified the prevalence of tinnitus in university students to be 21.2%, and the associated risk factors were noise exposure and smoking. It is recommended to use the VAS for screening purposes for people suffering from tinnitus.

The sample size of this study, along with the methodology used to determine the prevalence of tinnitus and risk factors, contributes to our recommendation to generalize the current research and for it to be used as a reference for the prevalence of tinnitus among university students or young adults in Jordan.

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عوامل انتشار ومخاطر الإصابة بطنين الأذن بين طلاب الجامعة

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الملخص

الخلفية والأهداف: هدفت الدراسة لدراسة عوامل انتشار الطنين والمخاطر المرتبطة بالطنين لدى طلبة الجامعة الأردنية.

المنهجية: هذه الدراسة المستعرضة لـ 1302 طالب (785 اناث و517 ذكور) عمرهم ما بين 17-30 سنة في الجامعة الأردنية درست من خلال نشر استبانة للطنين وخصائصه بالإضافة الى المخاطر المرتبطة به مثل الضجيج، التدخين، حساسية الربيع. درجة الانزعاج من الطنين تم تقييمها من خلال مقياس بصري من 1-10 حيث 1 هو الأقل انزعاج و10 هو الأكثر انزعاج. تم التحليل الاحصائي للبيانات من خلال برنامج التحليل الاحصائي SPSS.

النتائج: نسبة انتشار الطنين ضمن طلبة الجامعة الأردنية 21.2% حيث كانت النسبة أعلى بين الاناث 13.9% مقارنة مع الذكور 7.3%. أظهرت الدراسة ان 5% من الطلبة الذين يعانون من الطنين كان الطنين أبدو انزعاج شديد من الطنين. نسبة الطنين لدى المدخنين كانت 15% مقابل 6% لغير المدخنين، ونسبة الطنين للطلاب الذين تعرضوا للضجيج كانت 29%.

الاستنتاجات: أظهرت الدراسة ان النسبة لانتشار الطنين بين طلبة الجامعة 21.2% وهذه النسبة مماثلة للدراسات السابقة في نفس المجال. كما أظهرت النتائج ان مخاطر الطنين كانت التعرض للضجيج والتدخين.

الكلمات الدالة: الطنين، الضجيج من مصادر الترفيه، الطلاب، عوامل الخطر على الطنين، نسبة الانتشار.