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Tinnitus, Anxiety, Depression and Substance Abuse in Rock Musicians a Norwegian Survey

Carl Christian Lein Stormer
Tore Sorlie
Niels Christian Stenklev

Abstract

Objective: Rock musicians are known to have an increased prevalence of hearing loss and tinnitus. The aims of the present study were to examine the distribution of anxiety and depression symptoms among rock musicians with or without tinnitus and how these mental health indicators and internal locus of control influenced upon their tinnitus symptom concerns and the degree to which the tinnitus affected their lives. **Design:** The study was a questionnaire-based cross-sectional survey of subjects selected from a cohort of rock musicians. We recruited 111 active musicians from the Oslo region, and a control group of 40 non-musicians from the student population at the University of Tromso. **Results:** Among the rock musicians 19.8% reported permanent tinnitus *vs.* 0% among the controls. Musicians more often reported anxiety symptoms than controls (35.1% *vs.* 17.5%), however this prevalence was not different in musicians with and without tinnitus. Tinnitus-affected musicians reported depressive symptoms, significantly more than controls (13.6% *vs.* 5%). Rock musicians consumed more alcohol than controls, but alcohol consumption was unrelated to severity of tinnitus. Drug abuse was not more prevalent in rock musicians than in controls. Duration of tinnitus, internal locus of control, sleep disturbance and anxiety were significant predictors of how affected and how concerned musicians were about their tinnitus. **Conclusion:** Rock musicians are at risk for the development of chronic tinnitus, and they have an increased prevalence of anxiety. There is an association between chronic tinnitus and depressive symptoms in rock musicians, but our results are ambiguous. Although rock musicians have a chronic exposure to noise, noise-induced hearing loss is not the sole causative agent for the development of tinnitus.

Keywords: tinnitus, hearing disorders, rock musicians, anxiety, depression, alcohol, substance abuse.

UiT Norges Arctic University, Institute of Clinical Medicine, Tromso, Norway
Send correspondence to:
Carl Christian Lein Stormer
UiT Norges Arctic university, Institute of Clinical Medicine, Tromso, Norway, E-mail: carl.christian.lein.stormer@gmail.com
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INTRODUCTION

The word tinnitus comes from latin "tinnire"- "to ring", which, when referring to subjective tinnitus, describes the phenomenon of phantom sound perception[1] or the perception of an internal sound in the absence of an external stimulus[2]. The prevalence of mild tinnitus in industrial countries has been reported to be around 18% whereas 0.5% report that their tinnitus has severe negative effects on their daily life function[3]. Noise exposure has been known to be the most prevalent risk factor for developing tinnitus[4], and it is suggested that noise-induced damage leading to tinnitus occur at the level of the inner hair cell synapse[5]. Previous studies have indicated that there is an association between the concentrations of selected stress cytokines and degrees of tinnitus severity [6]. Rock musicians are known to be at risk of cochlear injury from excessive musical noise[7-9]. There is evidence of hearing loss and increased tinnitus prevalence in active rock musicians when compared to a normal population[7,9]. The causal relationship between hearing loss and tinnitus symptomatology in this population is not well established.

In our study we conducted transient otoacoustic emissions (TEOAE) and pure-tone audiometry tests, these results are presented in a previously published article[10]. We were unable to detect a significant loss in TEOAE SNRs amongst rock musicians. According to our definition, 37.8% of the rock musician sample had a hearing loss as measured by pure-tone audiometry. Significantly worse hearing thresholds were observed at almost all frequencies in rock musicians, the most pronounced threshold shift was found at 6 kHz. The prevalence of hearing loss was 2.5% in the control group. The degree of tinnitus severity was unrelated to TEOAE SNRs at any frequency, nor did we identify any significant relationship between pure-tone audiometric thresholds and degree of tinnitus severity. In the literature, perception of tinnitus severity is correlated more closely with psychological and general health factors than with audiometric parameters[11]. Depression and anxiety are significant factors in our understanding of differences in tinnitus symptomatology[12,13]. Personality traits, especially neuroticism, psychasthenia and schizoid traits have been associated with tinnitus perception[14] and neuroticism is known to correlate strongly with symptoms of general distress or negative affectivity[15].

Tinnitus is more troublesome when patients focus their attention on the perceived sound. It has been demonstrated that the severity of tinnitus correlates with external locus of control and a corresponding negative association between internal locus of control and tinnitus impairment[16]. In that study, the locus of control seemed to affect tinnitus severity only indirectly, as partial correlations indicated that this effect was mediated by the locus of control on anxiety and depression. Contrary to popular belief, abuse of alcohol has not been identified as a significant risk factor for tinnitus[17]. A negative association between physical activity and duration of tinnitus has been reported[18]. Some studies indicate that artists may have some mental characteristics that distinguish them from the general population. An increased prevalence of bipolar disorders has been demonstrated[12] and an association between creativity and certain personality traits have been reported as well[19]. In a cross-sectional survey of a young population of music students, those with permanent hearing-related symptoms from risky music listening reported increased presence of depressive symptoms and suicidal thoughts[20]. Another study reported a significant association between rock/metal music preference and suicidal thoughts[21] in comparison with a pop-preferences group. In the present study, we aim to assess the prevalence of various mental health indicators in a rock musician sample, and to examine how these indicators, in combination with internal locus of control, influenced their tinnitus symptom concerns and the degree to which the tinnitus affected their lives.

MATERIAL AND METHODS

Subjects

Rock musicians

Our working definition of a rock musician is a performing musician that classifies himself as operating within the rock music category. Several of our participants reported that they were also performing in other musical genres (pop, jazz, electro, hip-hop, country and others). In our analyses, all were pooled into our rock musician category. The musician sample was recruited in two sessions. We collaborated with Norsk Musikkråd (Norwegian Music Council) for the use of their BandOrg database for active rock musicians in the Oslo region. This database included 330 subscribing members. All were invited via electronic mail (e-mail). 20 responded initially via e-mail, a further 26 responded to a follow-up telephone inviting them to participate, yielding a total of 46 participants from the BandOrg sample. This part of the musician sample was not recruited randomly.

We had access to a comprehensive list of musicians performing at the Oya festival (major Norwegian rock music festival) in 2011-12. The list contained 110 bands, each consisting of 3-5 members. Using the randbetween function in Microsoft Excel (Microsoft corp., USA), 25 bands were drawn from this sample. A total of 102 musicians were invited by e-mail or phone, of which 71 musicians were included in our study. The most common reason for not participating was conflicting time schedules. In total, 117 rock musicians were included in our study, 102 male and 15 female. There were no significant differences in the distribution of demographic or other variables of interest between the Oya and BandOrg subsamples. Hence, we have pooled the two groups together for our rock musician sample. During the data sampling phase, 6 of the 117 musicians were excluded from the study (for cerumen occlusion, failure to answer the questionnaire or failure to attend the clinical examination). Hence, the total number of subjects in the musician group that was

included in our study was n = 111 (97 male, 14 female). The mean age of the musicians was 30.4 years.

Control group

For our control group, we invited an age- and gender-matched sample of students at the University of Tromso by informing about the project and inviting them to participate. We aimed to recruit a random sample by inviting a random selection of the volunteering student population. However, this was not possible in male students, only in females. Our students were from the Economy, Law, Health and computer science faculties. In total, 40 students were recruited for our control sample, 32 males and 8 females. The mean age of the control group 25.5 years.

Methods

All participants were examined by a team consisting of a medical doctor and an experienced audiologist performing otomicroscopy and a battery of audiological tests including pure-tone audiometry, transient evoked otoacoustic emissions and tympanometry. Audiological data have been published previously[10]. Clinical examinations were performed at the offices of Norsk Musikkråd in Oslo (musicians), and the Ear, Nose and Throat (ENT) department at the University Hospital of Northern Norway (controls). The staff and technical equipment were the same in both locations.

All responded to a web-based questionnaire with 85 items (appendix 1), distributed electronically via NSD (Norwegian Social Science Data Services). The questionnaire included questions about audiological symptoms including presence, duration and degree of tinnitus, noise exposition, musical instrument type, music-related activities, use of hearing protection and several psychometric instruments that are listed below. The questionnaire response rate was 97.3% in the musician sample and 100% in the control sample. In addition to gender and age, the following data related to tinnitus and music practice and exposure were used in this study: presence, duration and degree of tinnitus, frequency and duration of musical practice including performances, genre, instrument, use of hearing protection and frequency of leisure musical exposure.

Assessment instruments

Brief Illness Perception Questionnaire (BIPQ)

The BIPQ was designed to provide rapid assessment of a patient's personal perception of his or her illness[22]. BIPQ consists of eight items related to illness perception rated on a 0–10 scale. The eight aspects of illness perceptions are: Consequences, timeline, personal control, treatment control, symptom frequency, illness concern, understanding and emotional effect. The questions of Items 3, 4 and 7 are reversed, and higher scores are considered to be beneficial. The BIPQ has good test-retest reliability[22]. To adapt the questionnaire to individuals with tinnitus complaints, the word "illness" was replaced with "tinnitus complaints" for our study. Two of the items P1 "How much does your tinnitus affect your life" and P6 "How concerned are you regarding your tinnitus" were used as dependent variables in the regression analyses concerning those reporting tinnitus.

Internal Health Locus of Control (IHLC)

IHCL is a 6 item subscale of the Multidimentional Health Locus of Control Scales (MHLC), which also includes external control by powerful others and external chance control. Conceptually, HLC is a personality style variable, which has commonly been used as a predictor of medical outcomes, and of the individuals' adaptation to a variety of threatening health issues[23]. We use only the Internal sub-scale, hereunder 5 of the 6 items. Higher scores are known to be associated with better both somatic and mental health. Questions address illness in general, and are not specific for hearing problems.

Hospital Anxiety and Depression Scale (HADS)

The HADS is a 14-item scale that measures anxiety (HADS-A, 7 items) and depression (HADS-D, 7 items). A grand total score may be calculated, or HADS-A and HADS-D sum scores can be calculated individually. For our study, a cutoff score ≥ 8 within each subscale indicates a possible presence of a depression or anxiety disorder[24].

Sleep disturbance

Each participant answered questions based on Basic Nordic Sleep Questionnaire (BNSQ)[25] and Karolinska Sleep Questionnaire[26]: 1. Have you had difficulties to fall asleep during the past three months? 2. Have you experienced waking up too early without being to fall asleep again during the past three months? 3. Do you feel excessively sleepy at work and/or during free time (leisure time)? 4. Have you suffered from irresistible tendency to fall asleep while at work during the past three months? 5. Have you suffered from irresistible tendency to fall asleep during free time (leisure time) during the past three months? We also computed the scores of the five questions, yielding a sleep disturbance sum score.

The Alcohol Use Disorders Identification Test (AUDIT)

AUDIT is a standardized 10-item questionnaire that is used to identify persons with hazardous or harmful patterns of alcohol consumption, where three domains are addressed: Hazardous alcohol use, dependence symptoms and harmful alcohol use. In our study, a cutoff score of ≥ 8 (male) and ≥ 6 (female) was used as indication of risk[27].

The Drug Use Disorders Identification Test (DUDIT)

DUDIT is a parallel assessment instrument to AUDIT for identifying drug-related problems. The questionnaire consists of 11 items. For our study, a cutoff score of ≥ 6 (men) and ≥ 2 (female) indicates risk[28]. We also included survey items about physical activity and whether the musician had sought professional help for psychological problems.

Ethics

Informed consent was obtained from all participants. The protocol was approved by the regional ethics committee (2012/127/REK Nord). Where pathological findings were encountered at the clinical examination, subjects were advised to contact their general practitioner for a consultation.

Statistics

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 22. The distributions of all parameters were assessed using normal plots. The demographic and psychosocial data from both groups were compared, using t-test and cross-tabulation. The mean difference between groups was compared using independent-sample t-tests. Cross-tabulations with exact statistics (Pearson's chi-square test) were used to compare dichotomous variables. Linear regression was used to estimate how age, internal locus of control and various mental health indicators influenced illness perception (P1 and P6). Effect sizes were estimated by R2. For statistical significance, a cutoff at $p \leq 0.05$ was chosen.

RESULTS

Tinnitus

We observed a prevalence of chronic tinnitus, as defined by presence of permanent tinnitus, in our musician sample of 19.8% (20.6% of male musicians and 14.3% of female musicians, no significant difference between genders). 4.5% had never experienced tinnitus, 31.5% less than two minutes, 36.9% 1-2 days, 6.3% for weeks and 0.9% for months. The mean age of the musicians with chronic tinnitus was 33.4 (SD ± 5.6, range 23-47) years, and in the musician group as a whole it was 30.4 (SD ± 6.6, range 16-52) years). In our control group, no one reported chronic tinnitus, 22.5% had never experienced tinnitus, 77.5% less than two minutes. The mean age in controls was 25.5 (SD ± 4.7) years. Among subjects with chronic tinnitus, 68.2% experienced a beep, 31.8% a murmur, 36.4% a monofrequency sound, and 18.2% heard multiple frequencies, and 54% had bilateral symptoms. 22.7% had considered terminating their musical career because of their hearing issues, and 13.6% considered their symptoms a problem when performing. 40.9% had consulted a doctor about their hearing disorders, and 18.2% had sought professional help for psychological problems.

Mental health related parameters, internal health locus of control and illness perception

In the present sample the inter-item reliability (Cronbach's alphas) was as follows: HADS 0.85, HADS-A 0.87, HADS-D 0.75, IHLOC 0.77, AUDIT 0.74, DUDIT 0.7, sleep disturbance 0.74. Illness perception total score had a Cronbach's alpha of 0.60 (increasing to 0.73 after the removal of item 3). In table 1, we present an overview of mean scores (± SD) of our psychometric instruments for the rock musician sample as a whole, rock musicians with permanent tinnitus, rock musicians without permanent tinnitus (including those who had never experienced it) and controls. Comparisons of the means in these variables are reported as well.

Illness perception scores (table I) differ from the other psychometric tests in that it targeted subjects that had experienced or were experiencing tinnitus. The following groups were analyzed: Rock musicians who had experienced temporary tinnitus or had permanent tinnitus (n = 106), musicians with permanent tinnitus (n = 22), musicians who had experienced any duration of temporary tinnitus but did not have permanent tinnitus (n = 84), and control subjects who had experienced temporary tinnitus but did not have permanent tinnitus (n = 31). Comparing the groups using Student's t-test we found that tinnitus affected rock musicians' life significantly more, they thought it would last longer, they had less control of their symptoms, more treatment control, higher symptom frequency, more illness concern, showed more understanding of the condition and were more affected emotionally (table 1). Table 2 shows a correlation matrix for age, gender and relevant psychometric instrument scores for the constantly tinnitus-affected musician subsample (n = 22). Rock musicians had significantly higher HADS-A scores than controls (mean difference 2.31, p = 0.001), and a significantly higher proportion scored above the HADS-A cutoff score (35.1% *vs*. 17.5%, p = 0.045). Also, significantly higher HADS-A scores were observed in female than male musicians (p = 0.004, 57.1% *vs.* 32% above HADS-A cut-off). No significant differences where observed between musicians with and without tinnitus. No significant difference in HADS-D score was observed between musicians and controls (6.3% of musicians reported depressive symptoms (male 6.2%. female 7.1%) above the HADS-D cutoff, versus 5% of controls). The prevalence of depressive symptoms was 13.6% in tinnitus-affected musicians *vs.* 4.5% in musicians without tinnitus. However, this difference was not statistically significant (p = 0.116). The HADS-D scores in tinnitus-affected musicians were significantly higher than in controls (mean difference 1.65; t = 2.22, p = 0.031). In the regression analysis with HADS-D as the dependent variable and group (musicians *vs.* controls), age, gender and tinnitus duration as independents, tinnitus duration was the only statistically significant predictor (F = 2.579; p = 0.013). Alcohol abuse was more prevalent in rock musicians than controls (chi-square value 6.835 p = 0.009) with 57.7% of musicians at risk with an AUDIT score above cutoff. There was no significant difference between musicians with and without tinnitus. In table 2 we show that amongst tinnitus-affected musicians AUDIT only correlated significantly with DUDIT. No significant differences were observed between musician and controls, or musicians with or without tinnitus regarding drug abuse, when assessed by the DUDIT instrument (p > 0.05). Musicians exercise significantly less than controls (p < 0.05). No difference was observed between musicians with and without tinnitus when analyzed with the Student's t-test.

Table 1. Represent an overview of mean scores (± SD) of our psychometric instruments for the rock musician sample as a whole, rock musicians with permanent tinnitus, rock musicians without permanent tinnitus and controls.

	Musicians (n = 111)						Controls (n = 40)					
	Musicians (total) (n = 111)		Tinnitus (n = 22)		Without tinnitus (n = 89)				M vs. C	M^{t} *vs.* M^{wt}	M^{t} *vs.*C	M^{wt} *vs.* C
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Difference (mean)	Difference (mean)	Difference (mean)	Difference (mean)
Illness Perception (IP)*												
IP1. How much does your tinnitus	1.39	1.36	2.91	1.411	0.99	1.024	0.16	0.374	1.23 *	192 *	2.75 *	0.83 *
1P2. How long do you think the	4.72	4.26	9.55	1.184	3.45	3.845	1.94	3.119	2.78 *	6.1 *	7.61*	1.51
IP3. How much control do you feel	5.58	3.5	4.05	3.451	5.98	3.44	7.23	3.5	* -l.65	* -193	*-3.18	-1.25
IP4. How much do you think	3.25	2.79	4.41	2.789	2.94	2.721	1.77	2.404	1.48 *	1.47 *	2.64 *	1.17
1P5. How much do you experience	2.14	1.89	3.77	2.159	1.71	1.564	0.65	0.877	1.49 *	2.06 *	3.12*	1.06 *
1P6. How worried are you regarding	3.18	2.6	3.86	2.55	3	2.593	1.35	1.992	1.83 *	0.86	2.51 *	1.65 *
1P7. How well do you feel you	8	2.47	8.18	2.039	7.95	2.578	5.77	3.547	2.23 *	0.23	2.41 *	2.18 *
1P8. How much does your condition affect you emotionally?	1.86	2.1	2.86	1.612	1.6	2.135	0.87	1.204	0.99 *	1.26 *	1.99 *	0.73
Total IP Score	24.5	10.93	35.545	8.5564	21.643	9.606	12.516	7.7626	11.98 *	13.9 *	23.03 *	9.12 *
HADS												
HADS (HADS-D + HADS-A)	9.24	5.92	10.591	7.6011	8.9101	5.433	6.1538	4.83158	3.1 *	1.6808	4.43 *	2.76 *
HADS-D	2.68	2.75	3.5455	3.4049	2.4607	2.545	1.8974	2.3818	0.7826	1.0848	1.65 •	0.5633
HADS-A	6.57	3.94	7.0455	4.61341	6.4494	3.781	4.2564	3.19307	2.31 *	0.5961	2.79 •	2.19*
Internal Health Locus of Control (IHLC)												
If I get stick, it is my own behaviour that decides how fast I willl get Well	3.46	0.99	3.6364	0.9021	3.4157	1.009	3.1026	1.119	0.3574	0.2207	0.5538	0.3131
When I get sick, it is my own fault	2.5	1.33	2.5455	1.3707	2.4944	1.324	2.4359	1.4653	0.0641	0.0511	0.1096	0.0585
What primarily affects my health, is what I do myself	3.59	1.07	3.6364	0.9021	3.573	1.117	3.7692	1.0873	-0.1792	0.0634	-0.0735	-0.1962
If I take good care of myself, I can avoid getting sick	3.77	1.08	3.7727	0.8691	3.7753	1.136	3.8462	0.933	-0.0762	-0.0026	-0.0735	-0.0709
If I take the right precaution, I can remain healthy	3.76	0.94	3.7273	0.7025	3.765	0.989	3.8205	0.8545	-0.0605	-0.0377	-0.0932	-0.0555
Total IHLC score	17.08	4.02	17.318	3.0455	17.023	4.245	16.97	3.863	0.11	0.2959	0.3484	0.0525
AUDIT												
Total AUDIT score	8.27	4.9	9.3636	5.6362	8	4.695	6	4.0262	2.27 *	1.3636	3.26 *	2 *
DUDIT												
Total DUDIT score	1.59	3.14	2.0909	4.5346	1.4607	2.705	0.667	2.6391	0.923	0.6302	1.4239	0.7937
SLEEP DISTURBANCE												
Have you had difficulties to fall asleep during the past three months	1.46	1.007	1.45	1.057	1.46	1.001	1.54	0.854	-0.08	-0.01	-0.09	-0.08
have you experienced waking up too early without being to fall asleep again during the past three months?	1.01	0.939	1.32	1.171	0.93	0.863	0.9	0.788	0.11	0.39	0.42	0.03
Do you feel excessively sleepy at work and/or during free time (leisure time)?	2.05	0.862	2.32	0.646	1.99	0.898	2.28	0.826	-0.23	0.33	0.04	-0.29
Have you suffered from Irresistable tendency to fall asleep at work during the past three months?	0.74	0.86	0.86	0.889	0.71	0.855	1.18	1.023	* -0.44	0.15	-0.32	* -0.47
Have you suffered from Irresistable tendency to fall asleep during free time (leisure time) during the past three months	0.9	0.943	0.91	0.811	0.9	0.978	1.15	0.904	-0.25	0.01	-0.24	-0.25
Total sleep disturbance score	6.16	3.26	6.8636	3.4682	5.9888	3.207	7.0513	3.3083	-0.8913	0.8748	-0.1877	-1.0625

Table 2. Shows a correlation matrix for age, gender and relevant psychometric instrument scores for the constantly tinnitus-affected musician subsample.

	Age	Gender	HADS	HADS-D	HADS-A	AUDIT	DUDIT	IHLC	Sleep
Age		0.182	-0.237	-0.239	-0.214	0.249	0.245	0.321	0.045
Gender	0.182		0.209	0.091	0.277	-0.05	-0.149	0.126	0.199
HADS	-0.237	0.209		0.929**	0.962**	0.337	0.351	0.179	0.245
HADS-D	-0.239	0.091	0.929**		0.793**	0.381	0.357**	0.116	0.132**
HADS-A	-0.214	0.277	0.962**	0.793**		0.274	0.314	0.209	0.307
AUDIT	0.249	-0.05	0.337	0.381	0.274		0.701**	-0.007	0.117
DUDIT	0.245	-0.149	0.351	0.357	0.314	0.701**		-0.216	0.494
IHLC	0.321	0.126	0.179	0.116	0.209	-0.007	-0.216		0.126
Sleep	0.045	0.199	0.245	0.132	0.307	0.117	0.494*	0.126	
IP 1	0.283	0.365	0.152	0.05	0.213	-0.91	0.039	0.295	0.542*
IP 2	0.416	0.124	-0.392	-0.361	-0.38	-0.202	*-0.48	0.266	0.48*
IP 3	0.037	-0.004	0.107	-0.137	0.278	-130	0.101	0.218	*0.065*
IP 4	0.4	0.127	0.067	-0.035	0.135	-0.189	-0.18	0.494*	*-0.048
IP 5	0.201	0.184	0.067	-0.131	0.207	-0.114	0.051	0.193	0.25*
IP 6	0.556**	0.081	-0.02	0.053	-0.072	0.03	0.013	0.484*	*-0.051
IP 7	0.35	0.13	0.033	0.012	0.045	0.073	-0.095	0.435*	0.037*
IP 8	0.048	-0.073	0.139	-0.003	0.231	-0.036	0.158	0.203	0.252*

No significant differences in total sleep disturbance score were found between musicians and controls, nor between musicians with and without tinnitus using the Student's t-test ($p > 0.05$). Examining each sleep item separately, we found that musicians have a lesser tendency to fall asleep while at work than controls. Using the Student's t-test and ANOVA, we observed no significant difference in IHLOC sum score between musicians with and without tinnitus ($p > 0.05$). When analyzed by ANOVA, there were no significant differences in HADS-A, HADS-D, AUDIT or DUDIT between different musicians according to genre or instrument. Item 1 ("How much does your tinnitus affect for your life?" and item 6 ("How concerned are you about your tinnitus?") are both aspects of health-related quality of life. In table 3 and 4 we present the results of a series of linear regression analysis with these items as dependent variables and age, gender, IHLOC, duration of tinnitus and the various mental health related variables as predictors. The linear regression analyses revealed that sleep disturbance, tinnitus duration, IHLOC and anxiety was the significant predictors for both item 1 and 6, explaining 11.8/13.5%, 42.8/5.9%, 5.3/6.1% and 5.3/13.3% of their variation, respectively.

DISCUSSION

The prevalence of tinnitus in the rock music sample (19.8%) is elevated in comparison to a normal population, where the prevalence of frequent tinnitus in people < 30 years is 2.6%, 30-39 years 4.1% and 40-49 years 6.6%[29]. Our data corroborate previous studies on rock musicians, where tinnitus prevalence has been reported in 22.5-43% of musicians[7, 8,30]. It is noteworthy that none of the tinnitus-affected participants scored higher than 5 on the illness perception consequence scale (0-10), which indicates that none of the musicians were severely affected. Also, few of the affected musicians regarded their tinnitus as problematic when performing. There is a possibility that severely tinnitus-affected musicians would already have terminated their musical career due to tinnitus. This factor would represent a selection bias in our sample. Our study population was relatively young (mean age 30.4) and it could be argued that the durations of their careers were too short for the development of tinnitus. Tinnitus would appear to increase with age in our sample. Similar findings have been reported in a US study, where it was observed that frequent tinnitus increases with age, ranging from 2.6% < 30 years to a peak at 14.3% around 60-69 years[29].

It is noteworthy that musicians reported more anxiety than the controls. There is a possibility that this finding could be related to personality trait characteristics within a musician or artist sample. However, personality traits that have been found to be associated with a creative style - Conscientiousness and openness[19] - have been shown to have weak associations to emotional disorders[15]. In our study, musicians with tinnitus did not report higher anxiety levels than musicians without tinnitus. This contrasts the findings in a Belgian study where a significant relationship between both cognitive and somatic anxiety and tinnitus severity was found[13] and a US study where frequent tinnitus was associated with general anxiety disorder[29].

There was no more depression reported in the musician group than in controls according to the HADS-D cutoff, but there were significantly higher scores among the tinnitus-affected musicians than the controls. This

Table 3 and 4. Represent the results of a series of linear regression analysis with these items as dependent variables and age, gender, IHLOC, duration of tinnitus and the various mental health related variables as predictors.

Predictors	β[1]	SD[2]	Beta[2]	t	P	[3]ΔR[2]
Age	0.361	0.613	0.166	1.713	0.09	0.027
Gender	0.348	0.402	0.085	0.866	0.388	0.007
IHLOC	0.08	0.033	0.231	2.42	0.017	0.053
Tinnitus duration	0.601	0.068	0.654	8.818	0	0.428
Sleep disturbance	0.144	0.039	0.343	3.728	0	0.118
HADS-A	0.079	0.033	0.23	2.414	0.018	0.053
HADS-D	0.077	0.047	0.159	1.641	0.104	0.025
AUDIT	0.022	0.027	0.082	0.84	0.403	0.007
DUDIT	0.057	0.041	0.134	1.379	0.171	0.018
Sum R^2						0.736

[1]β is the unstandardized regression coefficient. 2Beta is the standardized coefficient.
[3]ΔR^2 is the explained variance.

Predictors	β[1]	SD[2]	Beta[2]	t	P	[3]ΔR[2]
Age	0.045	0.038	0.117	1.201	0.232	0.014
Gender	0.76	0.769	0.097	0.989	0.325	0.009
IHLOC	0.163	0.063	0.256	2.59	0.011	0.061
Tinnitus duration	0.427	0.167	0.243	2.556	0.012	0.059
Sleep disturbance	0.295	0.073	0.367	4.026	0	0.135
HADS-A	0.239	0.06	0.365	3.993	0	0.133
HADS-D	0.159	0.09	0.171	0.1766	0.08	0.029
AUDIT	0.065	0.051	0.125	1.287	0.201	0.016
DUDIT	0.063	0.08	0.078	0.793	0.43	0.006
Sum R^2						0.491

For footnotes see Table 3.

finding appears to corroborate a German study were depression was found to predict perceived severity of tinnitus[31]. However, another study failed to establish an association between depression and frequent tinnitus[29] and we did not observe that depression was a predictor of tinnitus symptom concern or the degree to which the tinnitus affected participants' lives. In a Brazilian study, it was suggested that there were three possible associations between depression and tinnitus, with depression affecting tinnitus, tinnitus predisposing depression, and tinnitus as a comorbidity in depressed patients[12]. Some may regard depression and tinnitus as possible co-existing symptoms in predisposed individuals, but from our data, we have no further indication of the relationship between the two entities. Contrary to popular belief, tinnitus-affected individuals did not have a higher alcohol or drug consumption than those without tinnitus, and though alcohol consumption was increased in rock musicians versus controls, this was not the case for drug use. Hence, the popular myth of the drug consuming rock musician has been falsified by our data.

Tinnitus is known to cause disruption of sleep patterns[3] and more tinnitus in people reporting little sleep (< 6 hours) has been reported[32]. We found no significant differences in reported sleep quality between musicians with and without tinnitus, but sleep disturbance positively predicted the degree of tinnitus-affection and concern (table 2). Several studies have previously demonstrated a negative correspondence between internal locus of control and tinnitus impairment[16,31]. We found no significant differences in internal health locus of control when the chronic tinnitus group was compared with other musicians, but we found IHLOC to be positively correlated with the degree of concern and the degree to which tinnitus affected the musician's life when looking at the whole tinnitus (any duration)- affected group which contrasts the findings of Budd and Pugh (1995). Internal control may correlate with introversion, which in turn is associated with greater attention to all intrapsychic phenomena - also disturbing ones. However, this needs further study. In retrospect, we could have included other survey parameters exploring the severity of tinnitus affection (i.e. Tinnitus Handicap Inventory[33]) and also among the chronic tinnitus sufferers apply variables assessing the duration from onset of symptoms and the pitch and loudness of their tinnitus. However, is our view that the illness perception questionnaire items are suitable for exploring essential health-related quality of life aspects of the condition.

CONCLUSION

Rock musicians are at risk for developing chronic tinnitus. There is an increased prevalence of anxiety in rock musicians, which is not associated with presence of permanent tinnitus. Depression could be associated with tinnitus in rock musicians, but our results are incongruous on this issue. Anxiety, sleep disturbance and internal health locus of control seem to predict the degree of affection and concern in tinnitus-affected musicians. Rock musicians have an increased risk of alcohol abuse, not drug abuse, but none of those factors are associated with presence of tinnitus.

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