

# Association of Tinnitus with Anxiety and Depression among Active-Duty Army Personnel and Veterans at Hospital Angkatan Tentera Tuanku Mizan, Malaysia

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## ABSTRACT

**Objectives:** To study the prevalence of tinnitus, its characteristic and its association with anxiety and depression among active-duty army personnel and veterans. This study also wants to determine the correlation of Tinnitus Handicap Inventory (THI) with Hospital Anxiety Depression Scale (HADS) among active-duty army personnel and veterans at Hospital Angkatan Tentera Tuanku Mizan.

**Materials and Methods:** A cross-sectional study was conducted at the Otorhinolaryngology Head and Neck Surgery Department of Hospital Angkatan Tentera Tuanku Mizan from January 2020 until June 2021, involving active-duty army personnel and veterans with at least 3 years of service. Those patients who fulfilled inclusion and exclusion criteria were recruited. Their feedback was recorded based on Malay version of Tinnitus Handicap Inventory (THI) and Malay version of Hospital Anxiety Depression Scale (HADS)

**Results:** 106 subjects responded to our questionnaires, (51 active-duty army personnel and 55 veterans) in which 4.7% (n=5) reported to have anxiety and none had depression. Overall mean score for Total THI was 27.66, suggesting that majority of our subjects only felt mild handicap due to their tinnitus. Individual THI subdomain mean scores shows that the functional subdomain (17.79) affects subjects the most as compared to the emotional (5.7) and catastrophic scores (4.21)

**Conclusion:** Tinnitus can occur in all degrees of hearing loss, and it is associated with poor functional THI scores. Tinnitus is associated with anxiety but not depression among army personnel. These findings suggest that tinnitus should be addressed by healthcare providers in the military in order to maximise function and Quality of Life (QOL) among the nation's military personnel.

**Keywords:** Tinnitus, Anxiety, Depression, Veterans, Active-duty army personnel, Hearing loss.

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## INTRODUCTION

Tinnitus is a common medical symptom that can be debilitating. It is derived from the Latin verb *tinnire* (to ring), the term tinnitus describes the conscious perception of an auditory sensation in the absence of a corresponding external stimulus. Tinnitus can be subjective, when the experience is of the individual alone, or, less commonly, objective, when an observer can hear the tinnitus. The sensation is generally of an elementary nature—descriptions of hissing, sizzling, and ringing are common. Tinnitus can sometimes be rhythmical or pulsatile. Pulsatile tinnitus can be synchronous with the heartbeat, in which case a vascular origin is likely, or asynchronous, in which case myoclonus of middle-ear or palatal muscles is probable<sup>1,2</sup>. Tinnitus can be constant or intermittent, and many patients experience more than one sound. It can be localised to one or both ears, and centrally within the head, although some patients describe an external point of origin. The onset of tinnitus can be abrupt, but it is insidious in most cases.

Tinnitus has been further classified according to its initial triggers as primary tinnitus, which is either associated with Sensorineural Hearing Loss (SNHL) or is idiopathic (or unknown cause), and secondary tinnitus, which is related to other causes such as an organic origin<sup>3</sup>. Large-scale population studies have identified other risk factors such as vascular disease, hypertension, diabetes, autoimmune disorders, head injury, and degenerative neural disorders<sup>4,5</sup>. A fundamental question in tinnitus pathophysiology concerns the neural component that generates tinnitus<sup>6,7</sup> initially postulated that tinnitus could originate in any relevant anatomical structure, from the ear throughout the central auditory pathways. Initial speculations favored a cochlear origin since tinnitus can be perceived in the ears and also due to the fact that there is a strong association between the frequency of psychoacoustic identified tinnitus and the audiometric profile of hearing thresholds<sup>8</sup>. Nowadays, it is well established that many forms of tinnitus reflect a complex interaction between peripheral and central mechanisms within the auditory pathway<sup>9</sup>. Usually two or more triggers (e.g., Noise exposure, hearing loss, emotional distress, and somatosensory factors) are necessary to elicit a noticeable tinnitus<sup>10</sup>.

In compensated tinnitus, the patient copes well with the tinnitus and there is little or no psychological distress. In decompensated tinnitus however, the tinnitus perception is considered uncontrollable and interferes with the patient's QOL, causing emotional and psychological distress<sup>11</sup>. Studies has shown that up to 77% of the tinnitus population may present with psychiatric comorbidities because of tinnitus<sup>12</sup>. Among them, anxious and depressive symptoms seem to be the most common complications with tinnitus<sup>13</sup>. Perception of tinnitus and negative emotions are amplified in a vicious negative feedback loop by the limbic system in the amygdala. When they are present together, there is amplification

and impairment of signals, resulting in persistence of both emotional and tinnitus symptoms<sup>14</sup>.

Tinnitus affects up to 30% of military veterans, a prevalence rate that is twice that of the nonveteran population<sup>7</sup>. According to the American Tinnitus Association, fifty million Americans suffer with tinnitus and tinnitus is the most prevalent service-connected disability among veterans. Ground infantries with bothersome or distracting tinnitus are more likely to have sleep disorders, which in turn affects their concentration, emotional stability, alertness, and the efficiency of operational missions such as stealth and readiness<sup>15</sup>. Whereas Malaysian army is the land component of the Malaysian Armed Forces. The army contributes to the national defence objectives through the provision of land and special operations capabilities. The army also provides security response to a wide range of incidents, such as bush fires, floods, and major events<sup>16</sup>. Army personnel in particular are exposed to noise levels and blast environments that can cause tinnitus and can serve as a model population for studying the impact on anxiety and depression.

## MATERIALS AND METHODS

This cross-sectional study was done from January 2020 until June 2021, involving the Otorhinolaryngology Head and Neck Surgery Department of Hospital Angkatan Tentera Tuanku Mizan. Veterans and active-duty army personnel with at least 3 years of service and they have complained of at least 3 months of primary subjective tinnitus were recruited in this study. Patients who are illiterate with secondary objective tinnitus, pre-existing anxiety and depression were excluded. A total of 106 participants fulfilled our inclusion criteria in which constituted of 51 active-duty army personnel and 55 veterans, had their medical records traced and responses to the Malay version of HADS and Malay version of THI were recorded. This study received ethical approval from both the university research ethics committee (UKM PPI/111/8/JEP-2021-386) and by the Hospital Angkatan Tentera Tuanku Mizan research ethic committee (HATTM/EK/18-03).

The Malay THI (Figure 1) is a translated and a validated form of the English version of THI that was done by Ewe et al<sup>17</sup>. It is to determine the subjective perception of tinnitus. It consists of 25 questions divided into three subgroups (functional, emotional, and catastrophic). 12 items are included in the functional scale, 8 in the emotional scale and 5 in the catastrophic scale. For each item the patient can assign a value of 0, 2 or 4 points. The final score is used to assign the subject to one of the 5 grades of severity characterized by rising level of handicap

The Malay HADS (Figure 2) is also a translated and validated version of the English HADS that was done by Yahya et al<sup>18</sup>. It is a 14 item self-assessment questionnaire to assess anxiety and depression. HADS is divided into two subgroups: the HADS-D for depression and HADS-A for anxiety, each consisting of 7 questions. Each item on the questionnaire is scored from 0 to 3 (total final score

**TINNITUS HANDICAP INVENTORY (THI-MALAY)**

Nama: \_\_\_\_\_ Tarikh: \_\_\_\_\_  
 Umur: \_\_\_\_\_ Jantina: L / P MRN: \_\_\_\_\_

**Arahan:** Baring soal berikut ini mengandungi 25 soalan. Sila jawab semua soalan. Tujuan soal-soal ini adalah untuk mengenalpasti kesan tinnitus terhadap kehidupan anda. Sila pilih SATU jawapan sahaja.

		YA (4)	KADANG-KADANG (2)	TIDAK (0)
1F	Adakah tinnitus yang dihadapi menyebabkan anda sukar untuk menumpukan perhatian?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2F	Adakah kekuatan tinnitus yang dihadapi menyebabkan anda sukar untuk mendengar?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3E	Adakah tinnitus yang dihadapi menyebabkan anda berasa marah?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4F	Adakah tinnitus yang dihadapi menyebabkan anda berasa keliru?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5C	Adakah tinnitus yang dihadapi menyebabkan anda berasa teresak?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6E	Adakah anda sering mengadu mengenai tinnitus anda?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7F	Adakah tinnitus yang dihadapi menyebabkan anda sukar untuk tidur?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8C	Adakah anda berasa tidak boleh sembuh daripada tinnitus?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9F	Adakah tinnitus anda mengganggu keseronokan dalam melakukan aktiviti - aktiviti sosial?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10E	Adakah tinnitus yang dihadapi menyebabkan anda berasa kecewa?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11C	Adakah tinnitus yang dihadapi menyebabkan anda berasa seperti mengidap penyakit yang teruk?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12F	Adakah tinnitus yang dihadapi menyebabkan anda berasa sukar untuk menikmati hidup?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13F	Adakah tinnitus mengganggu anda untuk bekerja atau menjalankan tanggungjawab di rumah?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14F	Adakah tinnitus yang dihadapi menyebabkan anda berasa mudah marah?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15F	Adakah tinnitus yang dihadapi menyebabkan anda sukar untuk membaca?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16E	Adakah tinnitus yang dihadapi menyebabkan anda berasa sangat kecewa?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17E	Adakah anda rasa tinnitus yang dihadapi menganggu hubungan dengan ahli keluarga dan rakan-rakan?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18F	Adakah anda berasa sukar untuk mengahai tumpuan daripada tinnitus kepada perkara-perkara lain?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19C	Adakah anda berasa tidak mampu mengawal tinnitus?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20F	Adakah tinnitus yang dihadapi menyebabkan anda cepat terasa letih?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21E	Adakah tinnitus yang dihadapi menyebabkan anda berasa murung?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22E	Adakah tinnitus yang dihadapi menyebabkan anda berasa rungut?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23C	Adakah anda berasa yang anda tidak lagi mampu untuk menghadapi tinnitus?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24F	Adakah tinnitus anda bertambah teruk apabila anda mengalami stres?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25E	Adakah tinnitus yang dihadapi menyebabkan anda berasa tidak selamat?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Jumlah</b>		<b>A=</b>	<b>B=</b>	<b>C=</b>
<b>JUMLAH SKOR (A+B+C)</b>				
<b>GRED</b>				

Grade  
 0-16: Slight or no handicap (Grade 1)  
 18-36: Mild handicap (Grade 2)  
 38-56: Moderate handicap (Grade 3)  
 58-76: Severe handicap (Grade 4)  
 78-100: Catastrophic handicap (Grade 5)

Ewe E, WZ Ishik, Anko, Aino A (2018). The Tinnitus Handicap Inventory & Mini-Tinnitus Questionnaire: Reliability & Validity of the Malay Version. *International Medical Journal*, 2(6): 1-3

Figure 1: The Malay version of THI.

**HOSPITAL ANXIETY AND DEPRESSION SCALE (HADS) - MALAY VERSION**

<b>Saya berasa tertekan / tersepit / serabut:</b>	A	<b>Saya berasa kurang / tidak secegas dahulu:</b>	D
<input type="checkbox"/> Sepanjang masa	3	<input type="checkbox"/> Hampir sepanjang masa	3
<input type="checkbox"/> Banyak kali / kerap kali	2	<input type="checkbox"/> Kerap kali	2
<input type="checkbox"/> Kadang-kadang	1	<input type="checkbox"/> Kadang-kadang	1
<input type="checkbox"/> Tidak langsung	0	<input type="checkbox"/> Tidak langsung	0
<b>Saya masih seronok melakukan perkara yang dahulunya menyeronokkan:</b>	D	<b>Saya berasa takut / bendebar-debar / gementar:</b>	A
<input type="checkbox"/> Seperti dahulu/biasa (tidak perubahan)	0	<input type="checkbox"/> Tidak langsung	0
<input type="checkbox"/> Tidak seseronok dahulu	1	<input type="checkbox"/> Jarang-jarang	1
<input type="checkbox"/> Seronok sedikit sahaja	2	<input type="checkbox"/> Agak kerap	2
<input type="checkbox"/> Tidak lagi/hampir tidak lagi keseronokan	3	<input type="checkbox"/> Kerap kali	3
<b>Saya selalu berasa ketakutan seolah-olah seperti sesuatu yang buruk akan berlaku:</b>	A	<b>Saya sudah hilang minat terhadap keterampilan diri sendiri:</b>	D
<input type="checkbox"/> Sememangnya dan amat teruk sekali	3	<input type="checkbox"/> Sememangnya agak kurang minat dari biasa	3
<input type="checkbox"/> Ya tetapi tidaklah terlalu teruk	2	<input type="checkbox"/> Kurang minat dari biasa / yang seharusnya	2
<input type="checkbox"/> Ada sedikit tetapi tidak membimbangkan saya	1	<input type="checkbox"/> Kadang-kadang mungkin kurang minat dari biasa	1
<input type="checkbox"/> Tidak ada langsung	0	<input type="checkbox"/> Tidak hilang minat - masih seperti biasa	0
<b>Saya boleh ketawa dan dapat menyukai / Nampak perkara-perkara yang lucu/kacau:</b>	D	<b>Saya berasa tidak tenang / gelisah / seolah-olah saya perlu sentiasa membuat kerja / bergerak:</b>	A
<input type="checkbox"/> Sememangnya seperti dahulu	0	<input type="checkbox"/> Sememangnya banyak kali	3
<input type="checkbox"/> Tidaklah seperti dahulu	1	<input type="checkbox"/> Agak kerap	2
<input type="checkbox"/> Sememangnya tidak seperti dahulu	2	<input type="checkbox"/> Tidak terlalu kerap	1
<input type="checkbox"/> Hanya kadang-kadang	3	<input type="checkbox"/> Tidak langsung	0
<b>Perkara-perkara yang melisaukan / membimbangkan kerap bermain di fikiran saya:</b>	A	<b>Saya sentiasa menghangatkan keceriaan / kegembiraan apabila melakukan sesuatu perkara:</b>	D
<input type="checkbox"/> Hampir sepanjang masa	3	<input type="checkbox"/> Sama seperti dahulu	3
<input type="checkbox"/> Banyak kali	2	<input type="checkbox"/> Tidak seperti dahulu	2
<input type="checkbox"/> Dari masa kesemasa	1	<input type="checkbox"/> Sememangnya amat kurang daripada dahulu	1
<input type="checkbox"/> Hanya jarang-jarang / kadang-kadang	0	<input type="checkbox"/> Tidak / hampir tidak berasa ceria langsung	0
<b>Saya berasa ceria:</b>	D	<b>Saya mengalami panik / keadaan gementar secara tiba-tiba:</b>	A
<input type="checkbox"/> Tidak ada langsung	3	<input type="checkbox"/> Sememangnya banyak kali / kerap kali	3
<input type="checkbox"/> Tidak selalu	2	<input type="checkbox"/> Agak kerap	2
<input type="checkbox"/> Kadang-kadang	1	<input type="checkbox"/> Tidak kerap / kadang-kadang	1
<input type="checkbox"/> Sepanjang masa	0	<input type="checkbox"/> Tidak pernah langsung	0
<b>Saya boleh berasa relaks dan duduk dengan selesa:</b>	A	<b>Saya dapat merasa nikmat / keseronokan apabila melakukan sesuatu seperti membaca buku yang menarik / mendengar radio / menonton rancangan televisyen yang menarik:</b>	D
<input type="checkbox"/> Sememangnya	0	<input type="checkbox"/> Kerap kali	0
<input type="checkbox"/> Selalunya / kerap kali	1	<input type="checkbox"/> Kadang-kadang	1
<input type="checkbox"/> Tidak selalu / kadang-kadang	2	<input type="checkbox"/> Tidak selalu	2
<input type="checkbox"/> Tidak boleh langsung	3	<input type="checkbox"/> Jarang-jarang sekali	3

Fariza Yafiza, Zaharuddin Othman. Validation of the Malay Version of Hospital Anxiety and Depression Scale (HADS) in Hospital Universiti Sains Malaysia. *International Medical Journal* 2015; 2(2): 80-82.

Figure 2: The Malay version of HADS.

between 0 and 21 for either anxiety or depression). In both sub-scales the total score of 8 indicates the cut-off point for anxiety or depression.

**Statistical Analysis:** Statistical analysis was performed using IBM SPSS 27. Patients' responses for the HADS and THI questionnaire were taken as the outcome measure. Exploratory data analysis is done to assess for normality using the Shapiro-Wilk test with a statistically significant value of  $p < .05$  signifying that the data is not normally distributed. Spearman's correlation test was used to test the correlation between THI and HADS.

## RESULTS

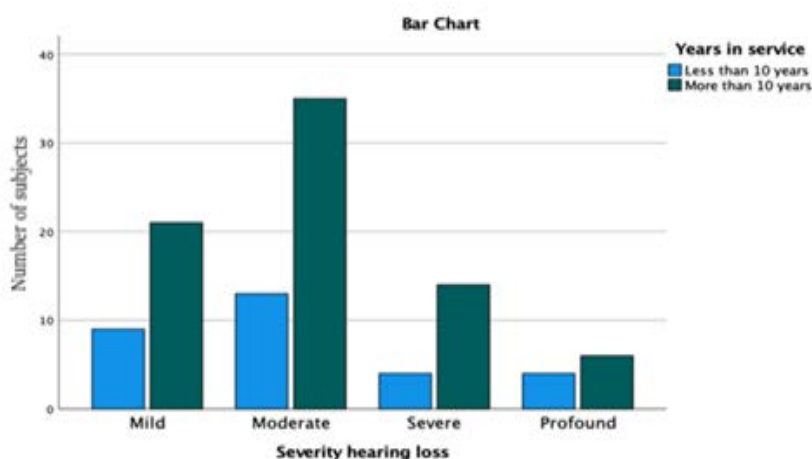
Out of 938 subjects that were screened throughout our study period, 133 were included in our study in which 106 subjects responded to our questionnaires giving an overall response rate of 79%. The prevalence of tinnitus among the subjects was 11.3% and out of that, 4.7% ( $n=5$ ) reported to have anxiety and none had depression.

Table 1 summarises the demographic data and clinical characteristics of tinnitus perceived by subjects in this study. The mean age of subjects was 58.1 (43-73) years old. Majority of our patients (94.3%) were male and only 6 (5.7%) were female. The Malay race predominates (74.5%) followed by the Chinese (14.2%), Indian (8.5%) and others (2.8%). There was almost equal distribution of subjects, 51 active-duty army personnel (48.1%) and 55 veterans (51.9%). Near two thirds (71.7%) of the subjects had served the army for more than 10 years in service (71.7%) as compared to less than 10 years in service (28.3%). The mean duration of reported tinnitus is 5.3 years. Majority of our subjects reported tinnitus occurs in bilateral ears (52.8%), persistent in character (68.9%), and a low pitch (41.5%) in perception of tinnitus.

Figure 3 showed more subjects with varying degrees of hearing loss after more than 10 years in service in which most of our subjects ( $n=35$ ) has moderate degree of hearing loss.

**Table 1:** Demographic description and clinical characteristics of tinnitus.

Demographics	n = 106
Age (mean±SD)	58.17 ±14.9 years
Gender	Male 94.3% (n=100) Female 5.7% (n=6)
Race	Malay 74.5% (n=79) Chinese 14.2% (n=15) Indian 8.5% (n=9) Others 2.8% (n=3)
Army Personnel	Active-duty personnel 48.1% (n=51) Veterans 51.9% (n=55)
Years in service	Less than 10 years 28.3% (n=30) More than 10 years 71.7% (n=76)
Duration of tinnitus (mean±SD)	5.3 ±3.07 years
Tinnitus Laterality	Unilateral 47.2% (n=50) Bilateral 52.8% (n=56)
Tinnitus Character	Intermittent 31.1% (n=33) Persistent 68.9% (n=73)
Perception of Tinnitus	Low pitch 41.5 % (n=44) High pitch 33% (n=35) Ringing 11.3% (n=12) Humming 14.2% (n=15)



**Figure 3:** Duration of service and severity of hearing loss.

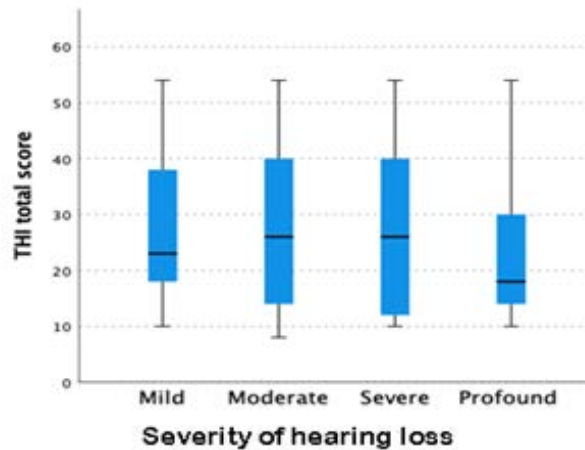


Figure 4: Severity of hearing loss and THI total score.

Table 2: Correlation of THI with HADS among subjects with tinnitus.

THI * HADS-A	Spearman's correlation	Significance
		(2 tailed)
Total THI * HADS Anxiety	-0.049	0.615
THI Functional * HADS Anxiety	-0.031	0.752
THI Emotional * HADS Anxiety	-0.027	0.78
THI Catastrophic * HADS Anxiety	-0.113	0.25
THI*HADS-D	Spearman's correlation	Significance
		(2 tailed)
Total THI * HADS Depression	-0.062	0.531
THI Functional * HADS Depression	-0.036	0.721
THI Emotional * HADS Depression	-0.02	0.835
THI Catastrophic * HADS Depression	-0.032	0.747

Overall mean score for Total THI was 27.7, suggesting that majority of our subjects only felt mild handicap due to their tinnitus. 28.3% had slight or no handicap, 41.5% had mild handicap and 30.2% had severe handicap. Individual THI subdomain mean scores shows that the functional subdomain (17.8) affects subjects the most as compared to the emotional (5.7) and catastrophic scores (4.2). Subjects with unilateral tinnitus had a higher mean THI score (59.2) signifying that tinnitus could be more bothersome compared to bilateral tinnitus.

Figure 4 shows equal distribution of total tinnitus handicap scores across all severities of hearing loss indicating that the degree of hearing loss does not affect overall THI scores.

Table 2 shows the correlation of THI with HADS among army personnel with tinnitus. There was a weak negative correlation between total THI scores and each individual subdomain with HADS anxiety and depression scores. Our result was not statistically significant hence there is no correlation between tinnitus, anxiety, and depression among our subjects. This is due to the lower scores obtained from HADS anxiety and depression scale.

## DISCUSSION

The prevalence of tinnitus is 11.3% among both active-duty army personnel (5.5%) and veterans (5.8%) which reflects the prevalence of tinnitus in general population of

the United States which is approximately 1 in 10 adults. Most studies in the western countries show a higher prevalence of tinnitus for males (80%) than females (20%)<sup>19</sup>. There was no comparable survey done locally among army personnel in Malaysia; however, in 1993, there was a cross sectional study done in Selangor, Malaysia<sup>20</sup>. It was to determine the prevalence of hearing loss and hearing impairment among 286 male subjects from a rural area in which the prevalence of symptoms of tinnitus was 19%. In another local study at our university, the prevalence of tinnitus was found to be 33.0% among the otology patients in the outpatient ear, nose and throat clinic, University Kebangsaan Malaysia (UKM) in 2002<sup>21</sup>. Tinnitus affects up to 30% of army veterans and 15% of active-duty personnel in the United States,<sup>7</sup> that is comparatively 3 times the prevalence of tinnitus which is seen in our study population leading us to think that this could possibly be a case of under reporting of symptoms in our cohort of patients.

There can be many factors that could contribute to anxiety and depression, majority of it could include trauma, stress due to an illness or stress build-up, different traits of personality, having blood relatives with anxiety or depression disorder, drugs, and alcohol. Theories of the severity of tinnitus causing depression and anxiety are well accepted. Functional MRI have shown increased signals in the middle and superior frontal gyri, the cingulate gyrus, the precuneus, and the parietal cortices

in tinnitus patients, verified by electroencephalography and magnetoencephalography studies. Functional imaging studies show that the subgenual Anterior Cingulate Cortex (sgACC) plays an important role in both coping styles<sup>22</sup> and depression<sup>23</sup>. The most recent study by Vanneste et al. showed that tinnitus patients using a maladaptive coping style show increased scores on the THI and experienced louder sounds and more distress in comparison to tinnitus patients using adaptive coping styles<sup>24</sup>. The sgACC and ventromedial prefrontal cortex are considered central dysfunction nodes in depression. The dorsolateral prefrontal cortex has been found to play an important role in anxiety<sup>25</sup>. This evidence further suggests why tinnitus can be associated with major depression, anxiety, and other psychosomatic and/or psychological disturbances.

An alternative theory suggests tinnitus is related to psychological disorders through a cortisol mediator<sup>26</sup>. Existence of glucocorticoid receptors in the inner ear has been proven, coupled with evidence that tinnitus patients have high cortisol levels which in turn could provoke anxious and depressive symptoms<sup>27</sup>. In 2019, Henry et al reported that 52% of army personnel and veterans with tinnitus were categorized as having anxiety and 21% were classified as having depression in which their subjects reported to have Post-Traumatic Stress Disorder (PTSD) from active combat missions due to tinnitus<sup>28</sup>. In contrast, our study showed only 4.71% were suffering from anxiety and none from depression. Our military soldiers are mainly stationed in peacekeeping missions rather than in the combat field which we postulate that the tinnitus self-retraining therapy to be manageable without dealing with PTSD. Majority of our subjects have persistent (70%) type of tinnitus which was similar to Henry et al. group which reported (77%) of tinnitus to be constant<sup>28</sup>.

Army personnel are exposed to noise which could later cause Noise Induce Hearing Loss (NIHL). Other factors that contribute to the acceleration of NIHL and related tinnitus might include smoking, diabetes, and low levels of exercise, as well as non-modifiable factors such as aging, genetics and racial or ethnic influences<sup>29</sup>. These factors should also be considered as it was not done in both Henry et al and our study. The functional ( $17.79 \pm 10.3$ ) subdomain of THI affected subjects the most as compared to the emotional ( $5.70 \pm 10.3$ ) and catastrophic scores ( $4.21 \pm 2.30$ ). This is evidenced by lower HADS-A ( $4.75 \pm 1.83$ ) and HADS-D ( $2.98 \pm 1.21$ ) as it did not affect the subjects THI-emotional and THI-catastrophic scores. This in turn could affect concentration, alertness, and the ability to carry out assigned tasks especially in combat situations<sup>15</sup>.

In our study, there was also no association between the degree of hearing loss and their discomfort caused by tinnitus based on THI score. Several studies have tried to show the possible association between THI questionnaire scores and degree of hearing loss<sup>30,31</sup> however, the results have been different and sometimes contradictory. Rajguru

et al reported that tinnitus from noise-induced hearing loss in military aircrew can cause fear to crewmembers to be downgraded from their flying duties<sup>32</sup>. There is also a clear association between shooting and hearing loss based on the asymmetry of the loss with right-handed firers having greatest loss in the ear closest to the muzzle which is the left ear<sup>33</sup>. Although hearing protection is routinely supplied to military personnel, it is often not used in active service because of the need to hear warning signals and instructions. Hence, NIHL among military personnel remains a serious problem<sup>34</sup>. Our study limitations were a relatively small sample size ( $n=106$ ) as compared to studies done abroad ranging from 200-300 subjects and single centre study as compared to multicentric. It is also unknown to what extent participants felt comfortable reporting the presence of tinnitus and the impact of tinnitus on their lives.

## CONCLUSION

Tinnitus can occur in all degrees of hearing loss, and it is associated with poor functional THI scores. There is association of tinnitus with anxiety but not depression among army personnel. These findings suggest that tinnitus should be addressed by healthcare providers in the military in order to maximise functionality and quality of life among our nation's active-duty army personnel and veterans.

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