Determining the Internal and External Reliability of Depression, Anxiety and Stress Scales (DASS-21) in Assessing Psychological Symptoms Among Patients with Tinnitus

Wan Suhailah Wan Husain[1], Azizah Othman[2], Nik Adilah Nik Othman[1], Wan Najibah Wan Mohamad[1], Mohd Normani Zakaria[1]

(This article has been published in NeuroQuantology, Volume 16, Issue 12, 2018)

ABSTRACT

Tinnitus ("ringing noise in the ear") is prevalent among adults with ear diseases. Psychological symptoms have been reported in many patients with tinnitus and research in this aspect is much relevant. The aim of the present study was to determine the internal and external reliability of Malay version of Depression, Anxiety and Stress Scales (BM DASS-21) in documenting psychological symptoms among patients with tinnitus. In this validation study, the BM DASS-21 was administered to 28 eligible Malay adults (14 males and 14 females) with main complaint of tinnitus, aged between 23 and 74 years (mean of 52.9 ± 12.8 years). After two weeks, they were instructed asked to fill in the questionnaire again. As revealed, the internal reliability of BM DASS-21 was found to be robust. Specifically, its Cronbach's alpha values were excellent for Depression subscale ($\alpha = 0.92$) and Stress subscale ($\alpha = 0.87$). A good alpha value was noted for Anxiety subscale ($\alpha = 0.79$). All the three subscales were significantly inter-correlated with each other ($r > 0.70$, $p < 0.05$). The test-retest (external) reliability of BM DASS-21 was found to be excellent (intraclass correlation = 0.77-0.88). In conclusion, given its high reliability, the BM DASS-21 can be used conveniently to assess psychological symptoms among patients with the complaint of tinnitus. It may guide clinicians in understanding the patients' psychological state, so that proper management can take place.

Key Words: DASS-21, Tinnitus, Psychological Symptoms, Reliability, Correlation

DOI Number: 10.14704/nq.2018.16.12.1876 **NeuroQuantology 2018; 16(12):67-72**

Introduction

Tinnitus is a perception of sound in the ear or head without any external sound stimulation (Tyler and Baker, 1983). It is in fact a common symptom among patients with ear diseases (Henry *et al*., 2005; Nondahl *et al*., 2011). Different from other type of auditory phantom perception such as auditory hallucination, tinnitus sufferers commonly report their perceived sounds as meaningless (Santos *et al*., 2012). Tinnitus can be of tonal or non-tonal type and is typically described as ringing, humming, hissing, whistling or buzzing sound (Henry *et al*., 2005). The exact mechanism for tinnitus generation remains controversial but generally both peripheral and central auditory systems have specific roles in tinnitus perception (Jastreboff, 1990). Clinically, tinnitus cases are commonly managed by hearing health practitioners such as otorhinolaryngologists and audiologists.

Corresponding author: Dr. Mohd Normani Zakaria
Address: [1]Audiology and Speech Pathology Programme, School of Health Sciences, Universiti Sains Malaysia, 16150 Kubang Kerian, Kelantan, Malaysia; [2]Department of Paediatric, School of Medical Sciences, Universiti Sains Malaysia, 16150 Kubang Kerian, Kelantan, Malaysia
e-mail ✉ mdnorman@usm.my

Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.
Received: 26 August 2018**; Accepted:** 22 November 2018

Tinnitus perception has a strong correlation with psychological problems. That is, the severity of tinnitus was found to be strongly related to elevated anxiety and depression (Scott and Lindberg, 2000). In line with this, 67% of individuals with tinnitus complaint described their tinnitus as mildly to extremely annoying (Zöger *et al*., 2006). Compared to non-tinnitus subjects, the anxiety and depression levels were found to be higher in those with tinnitus (Krog *et al*., 2010). As such, 45% of tinnitus patients with ear problems needed psychological treatments (Zöger *et al*., 2006). In this regard, psychological assessments and management can be beneficial to patients with tinnitus.

Many psychological instruments have been studied among patients with tinnitus including Structured Clinical Interview for DSM-III-R, Patient Edition (SCID–P), Hospital Anxiety and Depression Scale (HADS), Comprehensive Psychopathological Rating Scale (CPRS-S-A), Trait Anger Scale (STAS-T) and State Anxiety Scale (STAI-S) (Scott and Lindberg, 2000; Zöger *et al*., 2006). Clinically, these instruments are typically used by specialized mental health practitioners including psychiatrists and psychologists. To promote the use of psychological instruments among non-mental health clinicians (so that appropriate referrals can be made to psychiatrists as required), perhaps "simpler" instruments should be utilized. Depression, Anxiety and Stress Scales (DASS), for instance, can be used for this purpose.

The DASS questionnaire was originally developed with 42 items (Lovibond and Lovibond, 1995). Its later version that is simpler and more time effective consists of only 21 items (DASS-21) (Antony *et al*., 1998). Both versions of these questionnaires were found to be psychometrically robust (Lovibond and Lovibond, 1995; Antony *et al*., 1998). By using DASS, three emotional subscales (depression, anxiety and stress) can be assessed at the same time (Ramli *et al*., 2007). It is available in many languages including Malay (Ramli *et al*., 2009). The Malay version of DASS-21 (abbreviated as BM DASS-21) has been found to be valid and reliable (Ramli *et al*., 2007, 2009). Nevertheless, the psychometric property of BM DASS-21 has not been unveiled in patients with tinnitus. The DASS-42 questionnaire has been studied in patients with tinnitus but its reliability was not properly documented (Gomaa *et al*., 2014). To determine whether the BM DASS-21 is indeed suitable to be administered among tinnitus patients, there is a need to study about its psychometric property. The present study, therefore, was performed to determine the internal and external reliability of BM DASS-21 in assessing psychological symptoms among Malay patients with tinnitus.

Methods

Participants

In this validation study, 28 eligible Malay participants (14 males and 14 females) aged between 23 and 74 years (mean of 52.9 ± 12.8 years) were enrolled. They were randomly selected among patients of three main hospitals in East Coast of Malaysia. All of them reported to have constant tinnitus as the main complaint and had sensorineural hearing loss (with averaged hearing level at 500, 1000, 2000 and 4000 Hz frequencies of not more than 60 dB HL at least in one ear). Prior to the data collection, an ethical approval was obtained from the institutional ethics committee which is in accordance with the 1975 Declaration of Helsinki and its later amendments.

Study Procedure

The data collection took place in the audiology clinic within the respective hospitals. The demographic data of subjects were collected from the history taking during the initial visit. The information gathered including age, gender, occupation, duration of tinnitus, side of tinnitus, type of tinnitus, possible causes of tinnitus and information about decreased sound tolerance.

Prior to BM DASS-21 administration, all subjects underwent routine audiological assessments (otoscopy, tympanometry and pure tone audiometry) and tinnitus loudness matching procedure in a dedicated sound proof room. These assessments were performed according to the standard procedures using a clinical audiometer with TDH-39 headphone (Vernon and Meikle, 1988). The loudness of tinnitus for each subject was computed in decibels sensation level (dB SL).

The participants were then asked to fill in the BM DASS-21. The permission from the original author was granted before the commencement of this study. All subjects were required to report their psychological status over the past two weeks from 0 ("did not apply to me at all over the last two weeks") to 3 ("applied to me very much or most of the time over the past two weeks"). The final score of each subscale (Depression, Anxiety and Stress) was multiplied by two to represent the severity of each subscale.

To determine the test-retest (external) reliability of the BM DASS-21, it was administered again to all participants after the time interval of 2 weeks. During this period, no treatment was given to the participants (nevertheless, upon completion of the study, an appropriate clinical treatment was given to all participants as required).

Data analysis

Descriptive analyses were used to describe the demographic information of subjects. Cronbach's alpha was measured to determine the internal consistency of BM DASS-21. Since the data were found to be normally distributed ($p > 0.05$ by Kolmogorov-Smirnov test), Pearson correlation was employed to determine the correlation between the subscales of BM DASS-21. The Pearson correlation was also used to determine the correlation between BM DASS-21 subscales and demographic variables. The p values of less than 0.05 were considered statistically significant. Intraclass correlation (ICC) with a two-way mixed effects and absolute agreement type was employed to determine the test-retest reliability of BM DASS-21. An ICC value of less than 0.40 is considered poor, 0.40-0.59 as fair, 0.60-0.74 and 0.75-1.00 as excellent (Cicchetti, 1994). All data analyses were conducted with the Social Statistical Package for the Social Sciences (SPSS) software version 20 (SPSS Inc., Chicago, IL).

Results

As revealed in Table 1, of 28 subjects, 46% of them reported to have tinnitus for less than a year, 36% with tinnitus for less than 5 years and 18% with tinnitus for more than 5 years. Most of the subjects (68%, n = 19) worked as housewives, teachers or nurses, in which no exposure to occupational noise was reported. The remaining 9 subjects had history of noise exposure during their working hours. Their occupation was safety officer in oil and gas factory (n = 1), heavy machine controller (n = 1), car mechanic (n = 1), policemen (n = 3), army (n = 1), vocational teacher (n = 1) and forest officer (n = 1). In terms of tinnitus lateralization, slightly more than half of the participants (53%) reported to have tinnitus in the left ear. Sound intolerance problems were reported in only 5%-6% of the subjects (Table 1).

Generally, the reliability analyses found the BM DASS-21 to have good internal consistency. The Cronbach's alpha (α) values were 0.92, 0.79 and 0.87 for Depression, Anxiety and Stress subscales, respectively. The overall Cronbach's alpha for BM DASS-21 was 0.95. As shown in Table 2, the correlation analysis revealed strong positive correlations between the subscales ($r > 0.7$, $p < 0.05$), implying good internal reliability of BM DASS-21.

Table 3 shows the correlation results when age, tinnitus duration and tinnitus loudness were compared with the BM DASS-21 subscales. As revealed, a negative but significant correlation was found between age and Stress subscale of BM DASS-21 ($r = -0.39$, $p < 0.05$). That is, when the age increased, the stress level decreased. No such pattern was found for the other two subscales ($p > 0.05$). On the other hand, the tinnitus duration had no association with the psychological symptoms ($p > 0.05$). The loudness of tinnitus was positively correlated only with Anxiety subscale of BM DASS-21 ($r = 0.39$, $p < 0.05$). In this regard, when the tinnitus became louder, subjects would feel more anxious.

Table 1. Demographic data of participants in the present study

Demographic variable		n (%)
Gender	Male	14 (50)
	Female	14 (50)
Occupation	Exposed to occupational noise	9 (32)
	Non-exposed to occupational noise	19 (68)
Duration of tinnitus	1 to 12 month	13 (46)
	1 to 5 years	10 (36)
	More than 5 years	5 (18)
Localization	Right ear	8 (29)
	Left ear	15 (53)
	Both ears	4 (14)
	In the head	1 (4)
Sound intolerance	Misophonia	5 (18)
	Hyperacusis	5 (18)
	Phonophobia	6 (21)

Table 2. Correlation analysis between subscales of BM DASS-21

	Depression	Anxiety	Stress
Depression	1.00	0.76*	0.73*
Anxiety	0.76*	1.00	0.73*
Stress	0.73*	0.73*	1.00

*Significant at $p < 0.05$ (2-tailed). DASS, Depression Anxiety Stress Scales.

Table 3. Correlation results when age, tinnitus duration and tinnitus loudness are compared with BM DASS-21 subscales

Variable	Subscale of DASS		
	Depression	Anxiety	Stress
Age	-0.36	-0.31	-0.39*
Tinnitus duration	-0.11	-0.12	0.15
Tinnitus loudness (in dB SL)	0.15	0.39*	0.33

*Significant at $p < 0.05$ (2-tailed). DASS, Depression Anxiety Stress Scales; dB SL, decibels sensation level.

The intraclass correlation analysis revealed excellent test-retest reproducibility between the two sessions. Specifically, the ICC values were 0.78, 0.88 and 0.77 for Depression, Anxiety and Stress subscales, respectively.

Discussion

An instrument is said to be reliable if it produces stable and consistent results (Bradley, 1994). In the present study, the reliability of BM DASS-21 was determined by assessing its internal consistency and test-retest stability. In general, to achieve acceptable internal consistency, the Cronbach's alpha of an instrument should be at least 0.70 (Bradley, 1994). As shown by the high alpha values, the BM DASS-21 was found to have good internal consistency when assessing psychological symptoms of subjects with tinnitus. It is worth noting that the Cronbach's alpha values obtained in the present study are slightly higher compared to the previous studies on BM DASS-21 (Ramli *et al*., 2007, 2009). This discrepancy is possibly due to the methodological differences between the studies (i.e. different sample sizes and different types of subjects tested).

The internal consistency of BM DASS-21 was further tested by measuring the correlations between its subscales. As revealed, strong and significant correlations were found between the subscales implying good internal consistency of BM DASS-21. In line with the previous study outcomes, these results also showed that individuals with tinnitus tend to have depression, anxiety and stress symptoms (Gomaa *et al*., 2014). It is however uncertain whether these psychological symptoms are caused by the tinnitus or they are in fact the pre-existing conditions (before the tinnitus becomes annoying). It is worth noting that the tinnitus may not only contribute to depression and anxiety problems, it can also affect other important aspects of life such as sleep quality and concentration (Tyler and Baker, 1983; Scott and Lindberg, 2000; Henry *et al*., 2005). In a study by Scott and Lindberg (2000), the psychological symptoms between two groups of patients with tinnitus (i.e. the help-seeking group and non-help-seeking group) were compared. Relative to the non-help-seeking group, sleep and concentration problems were more significant in the help-seeking group.

The present study also found that the age was negatively correlated with the stress level. In this respect, when the age of tinnitus sufferers increases, the related psychological symptom and the impact of tinnitus to their general well-being would decrease. In line with this, it was reported that the tinnitus prevalence peaked at the age of 40 to 49 years (21.7%) and continually reduced to 4.1% at the age of more than 80 years (Shargorodsky *et al*., 2010). In this regard, older adults tend to accept tinnitus in a more positive way and their overall general health is also less affected (Nondahl *et al*., 2011). Furthermore, tinnitus may not be the main concern as the majority of older adults have elevated hearing thresholds and significant hearing difficulties, in which the use of hearing amplification devices is required (Roberts *et al*., 2010). Since hearing aids can be effective in reducing tinnitus severity, most of the older adults would be able to cope with their tinnitus and less likely to report it (Henry *et al*., 2017; Hodgson *et al*., 2017).

The tinnitus perception can be affected by variables including tinnitus loudness (louder tinnitus is more disturbing), the pattern of tinnitus loudness (non-fluctuating tinnitus is more disturbing than fluctuating tinnitus), pre-existing psychological conditions and general health (Kennedy *et al*., 2004). In the present study, the tinnitus loudness was significantly correlated with the anxiety level, which is sensible. In line with this, the loudness of tinnitus perception revealed significant correlations with tinnitus annoyance and depression (Meikle and Taylor-Walsh, 1984; Andersson, 2003; Hiller and Goebel, 2006; Wallhäußer-Franke *et al*., 2012). Moreover, the tinnitus loudness was found to be strongly correlated with the tinnitus annoyance when measured at the frequency with the best hearing level (Andersson, 2003).

The external reliability of BM DASS-21 was determined by assessing its test-retest reproducibility. As revealed, all three BM DASS-21 subscales were highly reliable when tested over time. The high temporal stability of DASS-21 has also been reported in other studies but not on participants with tinnitus (Timothy *et al*., 1997; Silva *et al*., 2016). In a study by Silva *et al*. (2016), the test-retest reproducibility of DASS-21 was assessed in non-clinical Brazilian adolescents (n = 25, aged between 10 and 19 years). The time interval between the first and second administration of DASS-21 was one week. The reported ICC values for Depression, Anxiety and Stress subscales were 0.86, 0.80 and 0.82, respectively. These values were slightly higher than that of the present study, which could be due to the methodological differences (i.e. age

of participants, clinical vs. non clinical samples and different time interval between the two sessions). Due to its excellent external reliability, the BM DASS-21 can be a useful tool to assess the effectiveness of specific interventional strategies among patients with tinnitus in future studies.

The present study had several limitations worthy to be highlighted. Firstly, the sample size was relatively small (n = 28) and more favorable outcomes might be obtained if more eligible subjects could be recruited. Nevertheless, it is worth noting that with the current sample size, the desired study outcomes have been in fact achieved. Secondly, this study did not compare the BM DASS-21 performance with other psychological instrument, and hence its concurrent validity was not determined. This can be the focus of future research on BM DASS-21, particularly when assessing participants with tinnitus.

Conclusion

Psychological symptoms are common in patients with tinnitus, in which psychological assessments and management can be clinically useful. As revealed by the robust internal consistency and excellent external reliability, the BM DASS-21 was found to be reliable in assessing psychological symptoms among Malay subjects with tinnitus. The psychological symptom (as represented by BM DASS-21 subscales) is also significantly correlated with age and tinnitus loudness. Based on its robust psychometric property, the BM DASS-21 can be conveniently used by mental and non-mental health practitioners in Malaysia to document psychological symptoms among Malay patients with tinnitus. As such, those with serious psychological disturbances (as revealed by the BM DASS-21 scores) can be referred to appropriate medical professionals to avoid further negative consequences of tinnitus.

Funding: Exploratory Research Grant Scheme (ERGS) (203/PPSK 6730078) by Ministry of Education Malaysia

References

Andersson G. Tinnitus loudness matchings in relation to annoyance and grading of severity. Auris Nasus Larynx 2003; 30(2): 129-133.

Antony M, Bieling PJ, Cox BJ, Enns MW, Swinson RP. Psychometric properties of the 42-item and 21-item versions of the Depression Anxiety Stress Scales in clinical groups and community a sample. Psychological Assessment 1998; 10(2): 176-181.

Bradley C. Handbook of psychology and diabetes: A guide to psychological measurement in diabetes research and practice. Harwood, 1994.

Cicchetti DV. Guidelines, criteria, and rules of thumb for evaluating normed and standardized assessment instruments in psychology. Psychological Assessment 1994; 6(4): 284-290.

Gomaa MAM, Elmagd MHA, Elbadry MM, Kader RMA. Depression, Anxiety and Stress Scale in patients with tinnitus and hearing loss. European Archives of Otorhinolaryngology 2014; 271(8): 2177-2184.

Henry JA, Dennis KC, Schechter MA. General review of tinnitus: prevalence, mechanisms, effects, and management. Journal of Speech, Language and Hearing Research 2005; 48(5): 1204-1235.

Henry JA, McMillan G, Dann S, Bennett K, Griest S, Theodoroff S, Silverman SP, Whichard S, Saunders G. Tinnitus Management: Randomized Controlled Trial Comparing Extended-Wear Hearing Aids, Conventional Hearing Aids, and Combination Instruments. Journal of American Academy of Audiology 2017; 28(6): 546-561.

Hiller W and Goebel G. Factors influencing tinnitus loudness and annoyance. Archives of Otolaryngology - Head and Neck Surgery 2006; 132(12): 1323-1330.

Hodgson SA, Herdering R, Singh Shekhawat G, Searchfield GD. A crossover trial comparing wide dynamic range compression and frequency compression in hearing aids for tinnitus therapy. Disability and Rehabilitation: Assistive Technology 2017; 12(1): 97-103.

Jastreboff PJ. Phantom auditory perception (tinnitus): mechanisms of generation and perception. Neuroscience Research 1990; 8(4): 221-254.

Kennedy V, Wilson C, Stephens D. Quality of life and tinnitus. Audiological Medicine 2004; 2(1): 29-40.

Krog NH, Engdahl B, Tambs K. The association between tinnitus and mental health in a general population sample: results from the HUNT Study. Journal of Psychosomatic Research 2010; 69(3): 289-298.

Lovibond SH and Lovibond PF. Manual for the Depression Anxiety Stress Scales. Psychology Foundation, 1995.

Meikle M and Taylor-Walsh E. Characteristics of tinnitus and related observations in over 1800 tinnitus clinic patients. Journal of Laryngology and Otology Supplement 1984; 9: 17-21.

Nondahl DM, Cruickshanks KJ, Huang GH, Klein BE, Klein R, Nieto FJ, Tweed TS. Tinnitus and its risk factors in the Beaver Dam Offspring Study. International Journal of Audiology 2011; 50(5): 313-320.

Ramli M, Mohd Arif F, Zaini Z. Translation, validation and psychometric properties of Bahasa Malaysia version of the Depression Anxiety and Stress Scales (DASS). ASEAN Journal of Psychiatry 2007; 8(2): 82-89.

Ramli M, Salmiah MA, Nurul Ain M. Validation and psychometric properties of Bahasa Malaysia version of the Depression Anxiety and Stress Scales (DASS) among diabetic patients. Malaysian Journal of Psychiatry 2009; 18(2): 1-6.

Roberts LE, Eggermont JJ, Caspary DM, Shore SE, Melcher JR, Kaltenbach JA. Ringing ears: the neuroscience of tinnitus. Journal of Neuroscience 2010; 30(45): 14972-14979.

Santos RM, Sanchez TG, Bento RF, Lucia MC. Auditory hallucinations in tinnitus patients: Emotional relationships and depression. International Archives of Otorhinolaryngology 2012; 16(3): 322-327.

Scott B and Lindberg P. Psychological profile and somatic complaints between help-seeking and non-help-seeking tinnitus subjects. Psychosomatics 2000; 41(4): 347-352.

Shargorodsky J, Curhan GC, Farwell WR. Prevalence and characteristics of tinnitus among US adults. American Journal of Medicine 2010; 123(8): 711-718.

Silva HA, Passos MH, Oliveira VM, Palmeira AC, Pitangui AC, Araújo RC. Short version of the Depression Anxiety Stress Scale-21: is it valid for Brazilian adolescents? Einstein (Sao Paulo) 2016; 14(4): 486-493.

Timothy AB, Bruce FC, William K, David HB. Psychometric properties of the Depression Anxiety Stress Scales (DASS) in clinical samples. Behaviour Research and Therapy 1997; 35(1): 79-89.

Tyler RS and Baker LJ. Difficulties experienced by tinnitus sufferers. Journal of Speech and Hearing Disorders 1983; 48(2): 150-154.

Vernon JA and Meikle MB. Measurement of tinnitus: An update. In: Kitahara M, editor. Tinnitus: pathophysiology and management. Igaku-Shoin Ltd, 1988, p. 36-52.

Wallhäußer-Franke E, Brade J, Balkenhol T, D'Amelio R, Seegmüller A, Delb W. Tinnitus: distinguishing between subjectively perceived loudness and tinnitus-related distress. PLoS One 2012; 7(4): e34583.

Zöger S, Svedlund J, Holgers KM. Relationship between tinnitus severity and psychiatric disorders. Psychosomatics 2006; 47(4): 282-288.