

The effect of psychological inflexibility on health-related quality of life, depression, and anxiety in patients with chronic tinnitus without hearing loss

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SUMMARY

OBJECTIVE: The purpose of this study was to investigate the relationship between psychological inflexibility, depression, anxiety, and quality of life in patients with chronic tinnitus without hearing loss.

METHODS: The study was carried out involving 85 patients with chronic tinnitus without hearing loss and a control group of 80 individuals. All participants completed the Acceptance and Action Questionnaire-II, the State-Trait Anxiety Inventory-Trait, the Beck Depression Inventory, and Short Form-36.

RESULTS: The patient group exhibited higher Acceptance and Action Questionnaire-II ($t=5.418, p<0.001$), State-Trait Anxiety Inventory-Trait ($t=6.592, p<0.001$), and Beck Depression Inventory ($t=4.193, p<0.001$) scores and lower physical component summary ($t=4.648, p<0.001$) and mental component summary ($t=-5.492, p<0.001$) scores than the control group. Psychological inflexibility predicted depression, anxiety, and impairment of quality of life. The effect of psychological inflexibility on physical component summary was mediated by depression ($\beta=-0.15, [95\%CI -0.299 \text{ to } -0.017]$), while its effect on mental component summary was mediated by anxiety and serial anxiety and depression ($\beta=-0.17 [95\%CI -0.344 \text{ to } -0.055]$ and $\beta=-0.06 [95\%CI -0.116 \text{ to } -0.100]$, respectively).

CONCLUSION: Psychological inflexibility plays an important role in patients with chronic tinnitus without hearing loss. It is associated with increased levels of anxiety and depression and decreased quality of life.

KEYWORDS: Tinnitus. Acceptance and commitment therapy. Depression. Anxiety. Quality of life.

INTRODUCTION

Tinnitus is defined as the perception of sound in the ear or head, with no identifiable external origin. The prevalence of tinnitus in the general adult population is between 11.9 and 30.3%¹. Tinnitus consists of not only a sensory component but also an emotional one reflecting discontent and associated distress². The presence of anxiety and depression in patients with tinnitus is associated with impairment of quality of life (QoL)³. While some studies have reported that tinnitus-related psychological stress is predominantly associated with anxiety, others have emphasized the role of depression, in particular, in triggering tinnitus-related psychological distress⁴. The audiological state most widely associated with tinnitus is subjective hearing loss, the presence of which contributes to impairment of QoL in patients with the condition⁵. Loss of hearing can significantly impact QoL and generally contributes to isolation, depression, and cognitive retardation⁶. This suggests that hearing problems affect the QoL in patients

with tinnitus. Hearing difficulties appear to be a multilayered, confounding factor between tinnitus and QoL, as a result of both their frequent association with tinnitus and their effects at different stages. While there have been studies including psychometric assessments in patients with tinnitus, the number of studies of patients with tinnitus, but without hearing loss, is relatively low. Psychological inflexibility, a transdiagnostic concept, is defined as a pattern in which behavior is excessively controlled by the individual's thoughts, feelings, and other internal experiences or in which these are avoided at the expense of more effective and significant actions⁷. A few studies have shown a relationship between acceptance, one of the main components of psychological flexibility, and various QoL parameters in patients with tinnitus^{8,9}. However, hearing loss was not excluded in these studies. To the best of our knowledge, there has been no previous investigation of the effect of psychological inflexibility on QoL in patients with chronic tinnitus without hearing loss. The purpose of

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this study was to test the following hypotheses in patients with chronic tinnitus without hearing loss: that impaired QoL in patients is associated with anxiety (H1), depression (H2), and psychological inflexibility (H3), and that psychological inflexibility mediates the effect of anxiety (H4) and depression (H5) on QoL.

METHODS

Patients presenting with tinnitus symptoms to the Alanya Alaaddin Keykubat University Education and Research Hospital between June 01, 2018 and August 30, 2021 were included in the study. A control group was established consisting of volunteers similar to the patient group in terms of age and sex and not meeting any of the exclusion criteria. The study was approved by the Alanya Alaaddin Keykubat University clinical research ethical committee (decision no: 2018/26, dated April 13, 2018) and was conducted in accordance with the principles of the Declaration of Helsinki. Written consent was provided by all participants.

Participants

The study group consisted of individuals aged between 19 and 67 years with subjective idiopathic tinnitus and normal hearing. The control group consisted of volunteers with normal hearing and no tinnitus, matched to the study group in terms of age, sex, and mean hearing thresholds. The entire study group underwent detailed physical and ENT examinations, two-channel audiometry (Interacoustics AC40 Clinical Audiometer; Interacoustics AS, Assens, Denmark), standard with-headphone conventional audiometry (TDH-39; Telephonics Co, Farmingdale, New York, USA), and impedance audiometry examinations. An A-type response was defined as normal at impedance audiometry¹⁰. The normal hearing sensitivity was defined as pure tone thresholds of 25 dB HL or better, at all frequencies studied in the 250 to 8,000 Hz range¹¹.

Exclusion criteria were abnormalities at ENT and/or audiometric examinations, drug use for tinnitus, recent ototoxic, diuretic, or chemotherapeutic agent use, acoustic trauma, vascular, metabolic, or ear diseases, vestibular diseases, hearing loss, or psychiatric diseases such as dementia and schizophrenia. Patients with organic tinnitus were also excluded from the study. Individuals with any psychiatric disease or hearing disorder were also excluded from the control group.

Instruments

Short Form-36 (SF-36): This 36-item test was developed for the measurement of QoL in clinical practice and research. Two

summary scales, physical component and mental component, can be evaluated by calculating the scores obtained from the subdimensions. The scales are evaluated between 0 and 100, with higher scores indicating better QoL¹². Koçyiğit et al.¹³ performed the Turkish adaptation and validity and reliability study of SF-36.

Acceptance and Action Questionnaire-II (AAQ-II): This scale was developed by Bond et al.⁷. The AAQ-II is a seven-point Likert-type scale with a single factor, consisting of seven items. High scores indicate high psychological inflexibility. The Turkish language version of the AAQ-II exhibits good internal consistency with a Cronbach's alpha of 0.84¹⁴. The internal consistency of the scale was calculated at 0.92 in this study.

Beck Depression Inventory (BDI): The BDI is a self-report scale consisting of 21 multiple-choice questions concerning the severity of depression¹⁵. Hisli¹⁶ carried out the Turkish validity and reliability study of the BDI. Higher scores indicate an increased depressive mood. The internal consistency of the scale was calculated at 0.89 in this study.

State-Trait Anxiety Inventory-Trait (STAI-T): Spielberg et al. developed this scale to measure state and trait anxiety¹⁷. Öner and Le Compte¹⁸ carried out the Turkish validity and reliability study of the scale. Higher scores obtained using the additional calculation method indicate high anxiety levels. The internal consistency of the scale was calculated at 0.79 in this study.

Statistical analysis

Statistical analyses were performed on the SPSS software (v. 22, SPSS, Chicago, IL, USA). The normality of distribution of variables was evaluated using skewness and kurtosis measurement, the values of which were regarded as normally distributed at a range of ± 2 ¹⁹. Multicollinearity was evaluated using variance inflation factor (VIF) values. Descriptive analyses were employed to assess the demographic variables and the mean scores for all variables. Differences between the tinnitus and control groups were compared using the t-test and χ^2 test. Pearson's correlation coefficients were calculated to investigate the relationships between AAQ-II, depression, anxiety, PCS, and MCS. The PROCESS macro (Model 6) on the SPSS software was used for mediation analysis. Two different models were established for the PCS and MCS outcome variables. Age, gender, and presence of chronic disease were controlled in both models. Significance tests for indirect effects were conducted using a 5,000-sample Bootstrap sampling and bias-corrected confidence levels set to 0.95. The effect was considered significant ($p < 0.05$) if the upper and lower bounds of the 95% deviation-corrected confidence interval did not include zero²⁰.

RESULTS

The study was performed with 165 volunteers (85 patients and 80 controls). Seventy-eight (43.3%) participants were women. The mean age was 41.41 (± 11.41) years. No significant difference was observed between the patient and control groups in terms of sex ($\chi^2=0.003$, $p=0.955$) or age ($t=1.396$, $p=0.165$). Anxiety, depression, and psychological inflexibility scores were significantly higher in the patient group compared to the control group, whereas PCS and MCS scores were lower (Table 1). Cronbach's alpha values showed that the measurement tools were suitable for the study group. All psychological measurement parameters were significantly correlated with one another (Table 2). The VIF values were within an acceptable range (VIF=1.507–1.703).

In the model where PCS was the dependent variable, AAQ-II, BDI, and STAI-T explained approximately 39% of the variance in PCS ($R^2=0.394$, $F_{(6,78)}=8.441$, $p<0.001$). The total AAQ-II effect ($\beta=-0.32$, $p=0.002$) and total indirect effect ($\beta=-0.19$, 95%CI -0.332 to -0.20) and its indirect effect via depression ($\beta=-0.15$, 95%CI -0.299 to -0.017) were found to be significant for the PCS variable. However, the indirect effect of the AAQ-II via STAI-T and STAI-T+BDI was not significant ($\beta=-0.03$ [95%CI -0.134 to 0.096] and $\beta=-0.01$ [95%CI -0.051 to 0.026], respectively). The effect

of the AAQ-II on PCS lost its significance when STAI and BDI were included in the model ($\beta=-0.13$ $p=0.31$) (Table 3).

The variables included in the model in which MCS was the outcome variable explained approximately 45% of the variance in MCS ($R^2=0.453$, $F_{(5,79)}=13.118$, $p<0.001$).

The analysis showed that AAQ-II had a significant negative effect on MCS ($\beta=-0.46$, $p<0.001$). In addition, the total indirect effect of the AAQ-II was also found to be significant ($\beta=-0.30$, 95%CI [-0.50 to -0.146]). While the indirect effect of AAQ-II via STAI-T and BDI+STA was significant ($\beta=-0.17$ [95%CI -0.344 to -0.055] and $\beta=-0.06$ [95%CI -0.116 to -0.100], respectively), its indirect effect via BDI was not significant ($\beta=-0.07$, [95%CI -0.186 to 0.024]). The effect of AAQ-II on MCS when all the variables were in the model was not significant ($\beta=-0.16$, $p=0.11$) (Table 3).

DISCUSSION

The most important finding of this study was the significant association between psychological inflexibility and health-related QoL, on both the MCS and PCS subscales, in patients with chronic tinnitus without hearing loss (H3). Impairment in both the physical and mental components of QoL increased in line with psychological inflexibility in the tinnitus patient group. Another important finding of this study is that depression (H5) and anxiety (H4) play a mediating role in the effect of psychological inflexibility on health-related QoL. The results of the study show that depression plays a mediating role in the effect of psychological inflexibility on PCS. Interestingly, anxiety did not mediate this effect. The presence of somatic depressive symptoms, such as sleep disorder, appetite changes, and loss of energy, may be associated with the mediatory effect on the physical component of QoL. Anxiety and anxiety-depression mediate the effect of psychological inflexibility on MCS. However, depression alone does not mediate this effect. A study involving different neurological patient groups reported that the effect of anxiety and depression on PCS and

Table 1. Comparison between the patient and control groups.

	Patient (n=85)	Control (n=80)	Group differences		Effect size ^a
			t	p	
AAQ-II	19.38 \pm 9.13	12.64 \pm 6.73	5.418	<0.001	0.84
STAI-T	44.68 \pm 7.41	36.39 \pm 8.73	6.592	<0.001	1.02
BDE	10.05 \pm 8.12	5.29 \pm 6.25	4.193	<0.001	0.66
PCS	48.99 \pm 9.33	55.28 \pm 7.93	-4.648	<0.001	0.73
MCS	43.36 \pm 9.38	51.26 \pm 9.09	-5.492	<0.001	0.86

t-Test. ^aCohen's *d* for t-tests. AAQ-II: Acceptance and Action Questionnaire-II, STAI-T: State-Trait Anxiety Inventory-Trait, BDI: Beck Depression Inventory, PCS: physical component summary, MCS: mental component summary.

Table 2. Correlation matrix of study variables.

	Tinni. Dura.	AAQ-II	STAI-T	BDI	PCS	Skew	Kurt	α
1. Tinni. Dura.	-							
2. AAQ-II	0.19	-				0.42	-0.62	0.92
3. STAI-S	0.08	0.59**	-			-0.35	-0.45	0.79
4. BDE	0.12	0.52**	0.52**	-		1.41	1.98	0.89
5. PCS	0.09	-0.31**	-0.34**	-0.48**	-	-0.88	0.21	0.74
6. MCS	-0.09	-0.52**	-0.62**	-0.46**	0.28**	-0.27	-0.15	0.72

Pearson's correlation test. ** $p<0.01$. AAQ-II: Acceptance and Action Questionnaire-II; STAI-T: State-Trait Anxiety Inventory-Trait; BDI: Beck Depression Inventory; PCS: physical component summary; MCS: mental component summary; Skew: skewness; Kurt: Kurtosis; Tinni Dura: Tinnitus duration; α : Cronbach's alpha.

Table 3. Mediation analysis for physical component summary and mental component summary result variables.

Mediation analysis for PCS		β	SE	p	95%CI	
					LLCI	ULCI
Total effect	AAQ-II→PCS	-0.32	0.10	0.002	-0.515	-0.118
Indirect effects	Total (AAQ-II →PCS)	-0.19**	0.08	-	-0.332	-0.020
	AAQ-II→BDI →PCS	-0.15**	0.07	-	-0.299	-0.017
	AAQ-II →STAI-T→PCS	-0.03	0.06	-	-0.134	0.096
	AAQ-II→BDI→STAI-T→PCS	-0.01	0.02	-	-0.051	0.026
Direct effect	AAQ-II→PCS	-0.13	0.12	0.31	-0.367	0.117
Mediation analysis for MCS						
Total effect	AAQ-II→MCS	-0.46	0.10	<0.001	-0.664	-0.264
Indirect effects	Total (AAQ-II →MCS)	-0.30**	0.09	-	-0.503	-0.146
	AAQ-II→BDI →MCS	-0.07	0.05	-	-0.186	0.024
	AAQ-II→STAI-T→MCS	-0.17**	0.07	-	-0.344	-0.055
	AAQ-II→BDI→STAI-T→MCS	-0.06**	0.03	-	-0.116	-0.010
Direct effect	AAQ-II→MCS	-0.16	0.11	0.16	-0.389	0.067

**p<0.05 for 95%CI does not include zero. CI: confidence interval; AAQ-II: Acceptance and Action Questionnaire-II; STAI-T: State-Trait Anxiety Inventory-Trait; BDI: Beck Depression Inventory; PCS: physical component summary; MCS: mental component summary. Statistically significant results are shown in bold.

MCS varied depending on the diseases involved. The authors reported that anxiety and depression generally contributed to MCS more than PCS, whereas depression was predominantly effective on the PCS subscale of QoL²¹. Considering the results of previous studies, together with those of the present research, these suggest that anxiety and depression may represent a separate sphere of interest for different dimensions of QoL. In our study group, psychological inflexibility, anxiety, and depression explained 39% of the variance in PCS and 45% of that in MCS. Psychological symptoms, rather than audiological components, are reported to affect QoL in patients with tinnitus, with psychological parameters explaining 61% of the variance in QoL and audiological parameters explaining only 4%²². Consistent with previous research, this study shows the importance of psychological factors in the impairment of QoL in patients with tinnitus. In agreement with previous research, in this study, scale scores for depression and anxiety were significantly higher in patients with chronic tinnitus without hearing loss^{23,24}. A growing number of studies show the efficacy of acceptance and commitment therapy (ACT) aimed at reducing psychological inflexibility, by including patients with tinnitus²⁵. This study suggests that in addition to reducing symptoms in patients with tinnitus, ACT can also improve their QoL. Transdiagnostic processes may be defined as common processes underlying different disorders. Psychological inflexibility is a transdiagnostic concept explaining numerous psychopathological processes²⁶. The

comorbidity of depression and anxiety is not unusual. Anxiety and depression are also co-present in 39.2% of patients with tinnitus, and this comorbidity appears to make a negative contribution to adverse outcomes in QoL²⁷. The tendency for comorbid presentations to be associated with greater impairment of QoL increases the importance of targeting transdiagnostic structures, such as psychological inflexibility for individuals experiencing comorbid problems.

There are several limitations to this study. The first is that the severity of the patients' tinnitus was not measured. The type of tinnitus (such as pulsatile or constant) was also not recorded. The cross-sectional nature of the study also necessitates a cautious approach to inferring causality amid our results. Our method of including the participants in the study (consecutive patients diagnosed with tinnitus presenting to the ENT clinic) may also have led to selection bias. The possibility must be considered of greater admission to the hospital in the group with more severe tinnitus complaints, or suffering from this condition, or whose functionality is also affected. Our study group may therefore represent a more severe part of the tinnitus group seen in the general population.

CONCLUSION

This study shows the importance of depression and anxiety in the diminution of QoL in patients with chronic tinnitus without

hearing loss and also reveals the contribution of psychological inflexibility as a single factor affecting all these structures. When considering the high comorbidity rates among depression, anxiety, and tinnitus and the negative impact these comorbid conditions have on treatment, transdiagnostic processes remain an important area of a treatment goal.

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AUTHORS' CONTRIBUTIONS

TK: Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Project administration, Resources, Software, Visualization, Writing – original draft. **CŞ:** Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Project administration, Resources, Software, Visualization, Writing – review & editing.

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