

Corinna Stobik\*  
Rainer K. Weber†  
Thomas F. Münte‡  
Marc Walter§  
Jörg Frommer¶

\*Westerwaldklinik Waldbreitbach,  
Clinic for Neurology and Neurological  
Psychosomatics, Germany

†Marienhospital Stuttgart, Clinic of  
Ear, Nose and Throat Medicine,  
Germany

‡Otto-von-Guericke-University  
Magdeburg, Institute of Psychology,  
Germany

§University of Basel, Clinic for  
Psychiatry, Switzerland

¶Otto-von-Guericke-University  
Magdeburg, Department of  
Psychosomatic Medicine and  
Psychotherapy, Germany

## Key Words

Tinnitus

Psychosomatic stress factors

Coping strategies

Comorbidity

# Evidence of psychosomatic influences in compensated and decompensated tinnitus

## Evidencia de influencias psicossomáticas en acúfenos compensados y descompensados

### Abstract

The purpose of this study was to evaluate the role and interaction of individual factors on decompensated tinnitus. Subjects consisted of 53 adult patients with chronic tinnitus. They were selected and assigned to two groups, compensated ( $n=28$ ) and decompensated ( $n=25$ ), according to the results of an established tinnitus questionnaire. Both groups were evaluated and compared. The patients with decompensated tinnitus suffered from more pronounced social disabilities, were more prone to depression, and used less effective techniques to cope with their illness. They showed a higher degree of somatic multimorbidity, with particularly strong correlations between tinnitus and the incidence of cardiovascular diseases and hypoacusis. As a consequence, in the psychosomatic tinnitus therapy, greater attention should be given to the treatment of the somatic complaints in addition to psychological and psychosocial aspects.

### Sumario

El propósito de este estudio fue evaluar el papel y la interacción de factores individuales sobre un acúfeno descompensado. La muestra consistió de 53 pacientes adultos con acúfeno crónico. Estos se seleccionaron y asignaron a los grupos: *compensado* ( $n=28$ ) y *descompensado* ( $n=25$ ), de acuerdo con los resultados de un cuestionario establecido para acúfenos. Ambos grupos fueron evaluados y comparados. Los pacientes con acúfeno descompensado sufrían de discapacidades sociales más pronunciadas, eran más propensos a la depresión y utilizaban técnicas menos efectivas para controlar su enfermedad. Ellos mostraron un mayor grado mayor de multi-morbilidad somática, con una fuerte correlación entre el acúfeno y la incidencia de enfermedad cardiovascular e hipoacusia. Como consecuencia, en la terapia psicossomática del acúfeno, debe prestarse mayor atención al tratamiento de las quejas somáticas, además de los aspectos psicológicos y psicossociales.

As far as its etiology and nosological classification are concerned, tinnitus aurium is a heterogeneous and multifaceted phenomenon involving both somatic and psychosocial factors. Different disorders and functional processes in the auditory system may contribute to generating tinnitus (Møller 1984, Eggermont 1990, Hazell & Jastreboff 1990, Jastreboff 1995). In pathophysiological terms, functional disorders of the inner and/or outer hair cells in the organ of Corti may give rise to the symptoms, resulting in conductive tinnitus. Damage to the auditory nerve may also play a contributory role, resulting in sensorineural tinnitus. Tinnitus may also occur on the level of the auditory cortex. Finally, it is widely accepted that central auditory processes might be modulated by psychosocial influences and that these influences may thus play a role in producing the subjective auditory impression resulting in central tinnitus. However, the task of diagnosing and evaluating tinnitus is rendered more complex by the facts that first, it is hard to pinpoint some of the potential causes in individual cases; and second, combinations of different tinnitus types are not only theoretically conceivable but might also occur in practice. A tinnitus is designated as compensated when the afflicted person registers his ringing in the ears, but does not essentially feel affected by it, or only feels impaired by it in specific situations such as quietness, stress, physical tension. A tinnitus is desig-

nated as decompensated when the afflicted person suffers considerably from his ringing in the ears. This often has far-reaching effects in all spheres of life, and is tied to the development of secondary symptoms, for example: trouble in falling asleep or sleeping through the night, concentration difficulties, anxiety and depression (Lenarz 1998a). For clinical practice, including the selection and implementation of psychotherapeutic treatments; it is decisively useful to classify tinnitus (relative to its secondary symptoms, psychiatric and psychosocial effects) as compensated or decompensated.

Thus far, only a limited number of studies (Svitak 1998, Delb et al, 1999) have compared compensated and decompensated tinnitus with the aid of standardized methods designed to measure subjective tinnitus stress, such as Goebel and Hiller's Tinnitus Questionnaire (Goebel & Hiller 1998a). These studies have focused on the question of why some sufferers experience their tinnitus symptoms as a severe impairment while others do not. Studies on comorbidity have found close correlations between decompensated tinnitus and psychiatric disorders, such as affective disorders, anxiety disorders, and somatoform disorders (Harrop-Griffiths et al, 1987; Sullivan et al, 1988; Hiller et al, 1997). It is not known, however, whether the psychological impairment is best regarded as a contributory cause or rather as a consequence of the auditory disorder.

Several studies have demonstrated that persons with decompensated tinnitus are prone to dysfunctional thoughts regarding their tinnitus (Gefken & Kurth 1992, Mertin & Kröner-Herwig 1997), are likely to be convinced of some sort of external control, and are prone to display ineffective or emotionally focused coping strategies (Budd & Pugh 1996, Dineen et al. 1997). Compared with persons with compensated tinnitus, patients with decompensated tinnitus report more difficulties in their personal life, particularly regarding interactions with others (Erlandsson & Hallberg 2000). The significance of cognitive factors in coping with tinnitus is mirrored in a preference for the use of cognitive behavioral therapy methods in the psychotherapeutic treatment of tinnitus (Henry & Wilson 2000, Andersson 2002, Kröner-Herwig et al, 2003). In addition, the importance of psychosocial stress factors in the emergence and chronification of tinnitus provides the rationale for the use of relaxation therapies (Winter et al, 1996).

While many studies so far have pointed to the contribution of psychosocial and interpersonal stress factors, somatic comorbidity as a factor which modulates coping abilities, has not received adequate attention yet. A number of possible physical factors that may evoke and sustain subjective tinnitus have been described (Lenarz 1992). Marciano et al (2003) examined a sample of 75 outpatients with tinnitus from an audiological clinic, and found that over three-quarters had medical disorders, along with psychological or environmental problems.

However, it is unknown whether and to what extent somatic factors influence the manner in which sufferers cope with tinnitus. Therefore the results of the clinical-psychological investigations were based on complaints reported by the patients themselves or registered with help of instruments based on self-judgement. The current study aims at further elucidating the interactions of somatic and psychosocial factors in compensated and decompensated tinnitus patients, as encountered in a rehabilitation hospital. In particular, we were interested in the question to what extent somatic factors might contribute to the decompensation of tinnitus.

We undertook the classification of patients into these two tinnitus groups based on level of discomfort, with the help of the German version of the Tinnitus Questionnaire (Hallam 1996) by Goebel and Hiller (1998a). This procedure was chosen because the questionnaire represents a standardized and established procedure, and corresponds to classifications used by Lenarz (1998a) in the course of developing guidelines for classifying compensated and decompensated tinnitus. We have dispensed with any further differentiation into graduated levels of subjective suffering from tinnitus, despite the danger of information loss, as such a graduation is not justified in view of the cost-effective aspects of establishing and implementing specific therapeutic offerings in the daily routine of a clinic.

As gender aspects in clinical studies were usually neglected in the past, but are increasing in interest in research (Erlandsson & Holgers 2001), we have, despite the low number of women in our sample, also collected this data for all the variables.

## Methods

### Subjects

The sample (n=83) comprises all inpatients and outpatients with chronic subjective tinnitus between the ages of 20 and 65,

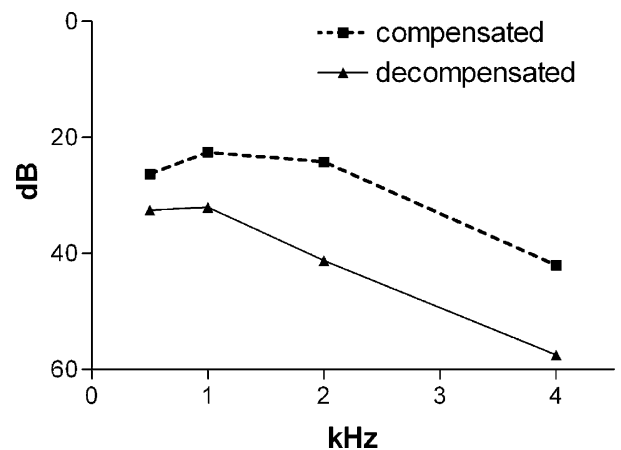
admitted between June 1999 and November 2000, to a rehabilitation clinic specializing in neurology and neurological psychosomatic disorders, the Westerklinik, Waldbreitbach (Germany). The treatment spectrum of the clinic includes all illnesses of the peripheral nervous system and psychiatric disturbances. Patients with serious psychiatric symptoms, such as psychoses, suicidal tendencies, or addictions are not handled here.

We defined tinnitus as chronic when the phenomenon had occurred constantly over a period of at least six months (Lenarz 1998a,b). During the period taken into consideration, we recruited a consecutive sample consisting of 83 patients with chronic tinnitus. Of these, 36 percent (n=30) were drop-outs, which included subjects unwilling (n=7) or unable (cognitive/language deficits, n=4) to participate, subjects with incomplete data sets (n=11), and patients with Ménière's disease or acoustic nerve neurinoma (n=8); and were not included in the final analysis. Thus, the study is based on a sample of 53 cases.

In the course of the admission diagnosis (days one and two), a thorough medical and psychiatric diagnosis was carried out, and the psychological and specifically tinnitus-related questionnaire was presented to the patients. Following this (days three and four), a structured tinnitus anamnesis was conducted.

### Somatic diagnostics

All subjects received a general physical, neurological, and ENT examination, including laboratory diagnostics, as well as EEG and ECG. The somatic disorders were classified according to ICD-10. The cardiovascular category included hypertonus, and coronary heart disease. The severity of a possible hearing disorder was assessed via audiogram. Hearing was determined at frequencies 0.5 kHz, 1.0 kHz, 2.0 kHz, and 4.0 kHz. Hearing loss was quantified as the average loss (dB) across these four frequencies. The groups of compensated and decompensated tinnitus were compared on the basis of this value. For unilateral tinnitus, hearing was assessed on the affected side, while for bilateral tinnitus the average of both sides was used. Hearing loss of more than 20 dB was classified as hypoacusis. The averaged audiogram for both groups is shown in Figure 1.



**Figure 1.** Averaged audiograms for compensated and decompensated tinnitus

### Psychometric instruments

Psychometric assessment was conducted prior to treatment by trained clinicians. An *Impairment Severity Score (BSS, Scheppank 1995)* was used to assess the global impairment of the patients. Tinnitus-specific aspects were assessed by a structured tinnitus anamnesis, comprising elements of Goebel's *Structured Tinnitus Interview (STI, Goebel & Hiller 1998b)* and some study-specific items. This interview gathered information on symptoms, presumed cause, course of the disorder, previous experience with treatment, present tinnitus-related impairments, and coping strategies. Visual analog scales, a method generally recognized in tinnitus research (Lenarz 1998b), were used to obtain estimates of subjective tinnitus loudness as well as tinnitus-related disturbance and limitation in day-to-day activities. The *Tinnitus Questionnaire (TF, Goebel & Hiller 1998a)* was additionally used to identify various aspects of patient stress and the severity of tinnitus. Further instruments included the *Symptom Checklist (SCL-90-R, Franke 1995)*, the *Disorder-coping Questionnaire (FKV, Muthny 1989)*, and the *Inventory of Interpersonal Problems (IIP-D, Horowitz et al. 2000)*. Sociodemographic and biographic data were collected with the *Social Data Questionnaire (PAT, Hartkamp 1986)*.

### Sample

A total of 53 fully documented patients (aged 37–63 years, mean 49.7+/-6.8 years), 12 of them women and 36 of them inpatients, was included. Based on the overall score of the tinnitus questionnaire, a measure used to determine subjective tinnitus stress was assigned to two groups. Patients with low to moderate tinnitus stress (0–46 points) were placed in the group compensated (n=28), those with severe to highly severe stress (47–84 points) to the group decompensated (n=25). The criteria for assignment were derived from previous studies (Goebel & Hiller 1998a, Lenarz 1992).

Inpatients and outpatients were about equally distributed across over both groups. Most patients had ten years of schooling (n=39), were employed as (skilled) workers (n=32), and were either married or living in a stable partnership (n=43). Significant differences were not found for the variables age, gender, schooling, employment, marital status, and inpatient or outpatient treatment between the two groups, nor between men (aged 37–63 years, mean 50.2+/-1.0) and women (aged 37–62 years, mean 48.0+/-6.6). They also did not differ with regard to the duration of an existing treatment (mean 6.5+/-7.5, range 1–47 years), or number or type of previous treatments. Most patients had previously undergone various treatment attempts: 32 patients once or twice, and 14 patients thrice or more. The majority had received medication (n=24) and/or treatment with an infusion (n=35). Nine patients had previous experience with psychotherapy. Seven patients had no previous treatment for their tinnitus.

### Statistical analysis

To compare the distribution of the two groups, the Mann-Whitney test was used for continuous and ordinal characteristics with at least ten attributes, while Fisher's exact test was used as a chi<sup>2</sup>-method for categorial characteristics. Hypothesis testing was done with a  $\alpha$ -level of 0.05.

## Results

### Diagnoses and impairment severity

Table 1 presents levels of subjective tinnitus stress and degrees of auditory impairment. Table 2 provides an overview of other disorders and associated levels of impairment severity. There were no significant differences between the two groups in terms of type and frequency of psychiatric disorders.

Apart from hypoacusis, which was found in 81 percent of all patients, the most frequent disorders diagnosed were those of the musculoskeletal system and connective tissue as well as endocrine, nutritional, and metabolic disorders and disorders of the circulatory and nervous system. Patients with decompensated tinnitus significantly more frequently displayed cardiovascular disorders than patients with compensated tinnitus. While there was no difference between the two groups with respect to type and frequency of auditory impairment – the majority of patients was found to have auditory disorders in the high-frequency range –, a significant difference in severity of the hypoacusis was found (Table 1 and Figure 1). Hearing loss was more pronounced in the decompensated group leading to greater impairments in communication.

Only eleven of the 43 patients with hypoacusis, three with compensated and eight with decompensated tinnitus, were using a hearing aid at the outset of therapy. A hearing aid was newly provided to 25 patients. Seven of the male patients, six with compensated and one with decompensated tinnitus, did not want a hearing aid.

Impairment severity scores indicated a more severe impairment of the decompensated group, especially in physical (p=0.002) and sociocommunicative (p=0.016) terms. Results of the structured tinnitus anamnesis are presented in Table 3.

Patients with decompensated tinnitus reported less ability to mask their tinnitus with background sounds and a frequent aggravation of the disorder in the presence of loud noises. These patients furthermore avoided otherwise enjoyable activities and were less able to divert their attention from their tinnitus. They felt impaired in their ability to sleep as well as in their capacity to concentrate.

Asked to specify conditions that aggravate their tinnitus, patients reported various combinations of different aspects such as noise, silence, physical and cognitive exertion, alcohol consumption, common colds, stress, and emotional strain. About half (n=24) of our overall sample (14 of the 25 patients with decompensated and 10 of the 28 with compensated tinnitus) named some form of emotional strain or stress as a condition that aggravated their tinnitus. In fact 26 out of 53 of our patients regarded stress and emotional strain as the cause of their tinnitus. The second most frequently named cause was noise (n=14). Of these, eleven traced the origin of their tinnitus to the effect of a chronic high level of noise at their workplace and three traced it to a traumatic explosion.

Patients with decompensated tinnitus more often reported feeling impaired since the first occurrence of tinnitus and more frequently experienced an increase in tinnitus intensity in the further course of their disorder.

No difference between patient groups was found for critical life events and psychosocial stress in partnership, family, and employment prior to the onset of tinnitus. About half (n=30) of our patients reported incisive changes in their lives prior to the

**Table 1.** Subjective tinnitus stress and degree of auditory impairment. p-values pertain to the comparison of sub-groups using Mann-Whitney U Test

	Total	Groups		<i>p</i> <sup>1</sup>
	<i>chronic tinnitus</i> ( <i>n</i> = 53) <i>M (SD)</i>	<i>decompensated</i> ( <i>n</i> = 28) <i>M (SD)</i>	<i>compensated</i> ( <i>n</i> = 28) <i>M (SD)</i>	
Subjective tinnitus stress:				
TF <sup>2</sup>				
Emotional stress	14.9 (19.2)	17.4 (4.2)	12.7 (26.1)	***
Cognitive stress	8.1 (4.2)	11.2 (2.7)	5.4 (3.2)	***
Tinnitus obtrusiveness	10.7 (3.6)	13.2 (2.1)	8.5 (3.1)	***
Auditory problems	7.0 (4.2)	10.0 (2.2)	4.4 (3.8)	***
Sleep disorders	4.3 (2.4)	5.5 (2.0)	3.3 (2.3)	**
Somatic complaints	2.5 (1.9)	3.2 (2.1)	1.9 (1.5)	**
Overall TF score	47.9 (24.9)	60.7 (7.8)	36.4 (27.9)	***
VAS <sup>3</sup>				
Loudness [0–100]	59.6 (22.8)	71.5 (19.6)	49.8 (20.8)	***
Disorder [0–100]	53.7 (29.8)	71.6 (24.6)	39.2 (25.7)	***
Limitation of activities: [0–100]	45.0 (28.8)	62.9 (21.9)	30.5 (25.7)	***
Degree of auditory disorder:				
0.5 kHz	29.3 (17.8)	32.6 (19.8)	26.4 (15.7)	
1 kHz	27.1 (19.1)	32.1 (20.8)	22.6 (16.6)	**
2 kHz	32.3 (25.0)	41.3 (27.4)	24.3 (19.7)	**
4 kHz	49.3 (19.7)	57.5 (27.1)	42.1 (23.9)	*
Total <sup>4</sup>	34.5 (19.7)	40.8 (21.4)	28.9 (16.4)	**

<sup>1</sup>Level of significance (unilateral): \**p* < =0.05, \*\**p* < =0.01, \*\*\**p* < =0.001

<sup>2</sup>TF: Tinnitus Questionnaire. <sup>3</sup>VAS: Visual Analog Scale, <sup>4</sup>Averaged audiogram

onset of tinnitus. However, patients with decompensated tinnitus more frequently reported distinct changes in their lives due to tinnitus. These ranged from impairments in their quality of life to reduced stress tolerance and/or psychosocial withdrawal.

#### Psychometric data

Table 4 presents the results of the questionnaire for the two groups of patients and the group of tinnitus patients as a whole.

For both groups, the SCL90-R questionnaire revealed increased T-scores for all individual scales as well as for the Global Severity Index (GSI). T-scores between 60 and 70 indicate emotional stress. Following  $\alpha$ -adjustment, patients with decompensated tinnitus were found to have significantly higher scores on the scales for depression, insecurity in social contacts, and compulsiveness. For both groups a variety of coping strategies was found, with a depressive coping style occurring more often in the decompensated group (Table 4). Following the  $\alpha$ -adjustment, the IIP-D-based analysis of interpersonal problems indicates a significant difference between patient groups in the overall score and the autocratic/dominant scale. Thus, patients with decompensated tinnitus were found to have more interpersonal problems and to be more dominant than patients with compensated tinnitus. There also was a non-significant trend for the decompensated group to be more rejecting/cold and introverted/socially avoiding (see Table 4). Significant differences between men and women are presented in Table 5.

#### Discussion

For physical, psychological, and communicative aspects, the results of the present study indicated greater impairment for patients with decompensated tinnitus. In addition to their tinnitus, patients with decompensated tinnitus had significantly more physical disorders, in particular disorders of the cardiovascular system. Due to the greater intensity of their hypoacusis, this group showed also more communication impairments than the other. There seems to be a correlation between heart/circulatory illnesses and specific psychosocial risk behavior (Schonecke & Herrmann 1996, Rief & Nanke 2003, Schächinger 2003).

To date, such a correlation for tinnitus has not yet been empirically established. However, Fichter and Goebel (1996) found an accumulation of certain basic attitudes among their psychotherapeutic tinnitus patients, such as the existence of a high need for control, perfectionism, a basic attitude of needing to see things through to the end, as well as various behavior patterns similar to a so-called Type A (inner restlessness, hectic lifestyle, and time- pressured). This could hint at a possible correlation between tinnitus and cardiovascular disturbances. It is known for sure that chronic illnesses often go hand in hand with high stress loads in the psychosocial area, which themselves represent a stress factor that can influence the further course of the illness (Schächinger 2003) and the process of coping with additional symptoms such as tinnitus.

**Table 2.** Frequency of occurrence of psychiatric and somatic diseases and disorders, and impairment severity (BSS) in the overall group and the two study groups

	<i>Total</i>	<i>Groups</i>		<i>Exact Fisher Test P<sup>1</sup></i>
	<i>chronic tinnitus</i> ( <i>n</i> = 53) <i>N</i> (%)	<i>decompensated</i> ( <i>n</i> = 25) <i>N</i> (%)	<i>compensated</i> ( <i>n</i> = 28) <i>N</i> (%)	
<b>Psychiatric disorders:</b>				
Stress reaction/adjustment disorders	14 (26.4)	7 (28.0)	7 (25.7)	
Affective disorders	12 (22.6)	8 (32.0)	4 (14.3)	
Personality disorders	10 (18.9)	4 (16.0)	6 (21.4)	
Somatoform disorders	8 (15.1)	4 (16.0)	4 (14.3)	
Anxiety-related disorders	7 (13.2)	3 (12.0)	4 (14.3)	
Persons without psychological disorder	6 (11.3)	2 (8.0)	4 (14.3)	
<b>Somatic disorders and diseases<sup>2</sup>:</b>				
Hypoacusis	43 (81.1)	22 (88.0)	21 (75.0)	
Musculoskeletal system and connective tissue	26 (49.1)	12 (48.0)	14 (50.0)	
Endocrine, nutritional, metabolic disorders	19 (35.8)	9 (36.0)	10 (35.7)	
Degenerative cardiovascular disorders	15 (28.3)	12 (48.0)	3 (20.7)	**
Nervous system	10 (18.9)	4 (16.0)	6 (21.4)	
<b>Impairment severity (BSS):</b>				
Light disorder	9 (17.0)	2 (8.0)	7 (25.0)	***
Significant disorder (morbidity)	12 (22.6)	3 (12.0)	9 (32.1)	
Disorder involving severe impairment	18 (34.0)	9 (36.0)	9 (32.1)	
Extremely severe disorder	12 (22.6)	10 (40.0)	2 (7.1)	
Severely impaired in every respect	2 (3.8)	1 (4.0)	1 (3.6)	

<sup>1</sup>Level of significance: \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\*  $< 0.001$

While the majority of patients in both study groups assumed that stress and emotional strain were conditions that evoked or aggravated their tinnitus, patients with decompensated tinnitus far more frequently reported psychosocial impairments attributed to tinnitus. They felt more impaired by tinnitus, saw themselves as more restricted in their activities, and were less able to distract their attention from their tinnitus. They showed higher levels of psychological stress and had more severe problems in interpersonal relations. They proved to be more autocratic and, in tendency, more rejecting and introverted as well. Besides a more depressive approach in dealing with their condition, these patients also undertook clear-cut efforts to cope with their condition in an active and problem-oriented way, including conscious diversion and self-rehabilitation efforts. In keeping with the hypotheses formulated above, patients with decompensated tinnitus were thus found to be more markedly impaired in all studied areas. Our results therefore pinpoint persons with decompensated tinnitus as a psychosomatic problem group (Scott & Lindberg 2000).

There are certain limits to the generalization of our results. First, most patients recruited for the present study were insured by a particular kind of institution, which mainly covers skilled and unskilled workers. Therefore, a certain social bias was introduced. Possibly (as we can only speculate here) these patients are less likely to seek out psychotherapeutic help or perhaps their sufferings are taken less seriously by those giving treatments. A similar assumption was made by Erlandsson and Holgers (2001) for the differences found in their study between

men and women. This would also explain the relatively long-lasting cases of patients with decompensated tinnitus enduring a continually high level of suffering and the lack of a prior hearing aid recommendation, for which the patients in our study were very motivated. The predominance of men in our study is representative of similar clinics in Germany. Because of the uneven distribution of men and women, the gender-related results must be viewed critically.

As such it is difficult to estimate, for example, to what extent the lack of subjective disturbance among women, or the increased occurrence of hypoacusis among men in our sample are rather accidental results or whether they represent clinically meaningful differences. An explanation for our finding of a greater impairment of hearing among men could be the noise exposure at the workplace more often experienced by them. Men indicated a worse talent for disguising their tinnitus, a lower ability to distract themselves from it (by structured tinnitus anamnesis), more restriction in their activity (visual analog scale) and sleep impairment (tinnitus questionnaire). Women had higher values on the Inventory of Interpersonal Problems 'too caring/amicable' scale. This could be showing the existence of traditional gender roles. However, the results could indicate the influence of gender-specific and socio-economic aspects on illnesses and their handling, and therefore should find increased consideration in future tinnitus studies (Erlandsson & Holgers 2001) and psychosomatic-oriented treatment. The lack of course-related data in our sample and the lack of a comprehensive audio diagnosis, such as conducting speech audiometry, constitute other limitations.

**Table 3.** Important differences between patients with decompensated and compensated tinnitus revealed by structured tinnitus anamnesis

	<i>Groups</i>		<i>Exact Fisher Test P<sup>1</sup></i>
	<i>decompensated (n = 25) N (%)</i>	<i>compensated (n = 28) N (%)</i>	
Sleep impairment			
1–3 nights/month	5 (20.0)	13 (46.4)	
1–3 nights/week	3 (12.0)	5 (17.9)	
4–7 nights/week	17 (68.0)	10 (35.7)	
Impairment of concentration			***
Never or very seldom	1 (4.0)	8 (28.6)	
sometimes	2 (8.0)	9 (32.1)	
often	5 (20.0)	7 (25.0)	
very often	9 (36.0)	3 (10.7)	
always	8 (32.0)	1 (3.6)	
Refrain from activities (enjoyment)			***
never or very seldom	2 (8.0)	19 (67.9)	
sometimes	4 (16.0)	6 (21.4)	
often	2 (8.0)	3 (10.7)	
very often	13 (52.0)	0 (0.0)	
always	4 (16.0)	0 (0.0)	
Able to divert attention			***
never or very seldom	17 (68.0)	5 (17.9)	
sometimes	7 (28.0)	8 (28.6)	
often	1 (4.0)	6 (21.4)	
very often	0 (0.0)	5 (17.9)	
always	0 (0.0)	4 (14.3)	
Able to mask			*
never or very seldom	14 (56.0)	8 (28.6)	
sometimes	10 (40.0)	8 (28.6)	
often	0 (0.0)	4 (14.3)	
very often	1 (4.0)	4 (14.3)	
always	0 (0.0)	4 (14.3)	
Change for loud background noise			**
volume declines	1 (4.0)	6 (21.4)	
does not change (or hardly changes)	13 (52.0)	20 (71.4)	
volume increases	11 (44.0)	2 (7.1)	
Duration of experienced impairment			*
right from the start	19 (76.0)	12 (42.9)	
in the course of time	6 (24.0)	14 (50.0)	
never impaired	0 (0.0)	2 (7.1)	
Change of volume over the course of time			***
has increased	20 (80.0)	7 (25.0)	
has remained essentially the same	4 (16.0)	19 (67.9)	
has decreased	1 (4.0)	2 (7.1)	
Changes in life since onset of tinnitus	14 (56.0)	16 (57.1)	**
Changes in life due to tinnitus	23 (92.0)	16 (57.1)	

<sup>1</sup> Significance (bilateral): \*p < =0.05, \*\*p < =0.01, \*\*\*p < =0.001

**Table 4.** Comparison of questionnaire results for patients with decompensated and compensated tinnitus

Questionnaire <sup>1</sup>	Groups		Mann-Whitney Test
	decompensated	compensated	
<b>SCL-90-R</b>			
Somatization	69.6 (11.6)	63.7 (11.8)	.020
Compulsion	70.8 (13.1)	63.3 (12.4)	.005*
Insecurity in social contacts	65.9 (12.9)	57.2 (13.5)	.006*
Depression	70.8 (11.4)	61.8 (14.8)	.007*
Anxiousness	69.0 (10.3)	60.7 (13.4)	.013
Aggression/hostility	62.0 (10.9)	56.3 (10.3)	.012
Phobic anxiety	66.2 (12.5)	58.9 (13.8)	.022
Paranoid ideas	59.5 (13.1)	55.5 (12.9)	.112
Psychoticism	65.3 (11.1)	59.6 (12.4)	.051
GSI	72.1 (10.0)	60.6 (15.7)	.002*
<b>FKV</b>			
Depressive coping	3.2 (1.0)	2.0 (0.7)	.000*
Active problem-oriented coping	3.4 (0.8)	3.1 (0.7)	.140
Diversion and self-rehabilitation	3.1 (0.8)	3.0 (0.7)	.314
Religiosity and search for meaning	2.5 (0.9)	2.3 (1.1)	.168
Playing down and wishful thinking	2.3 (0.8)	2.1 (0.9)	.167
<b>IIP-D</b>			
PA: too autocratic/dominant	7.6 (4.2)	4.6 (4.4)	.004*
BC: too aggressive/competitive	8.6 (4.6)	7.3 (5.5)	.132
DE: too rejecting/cold	11.1 (6.1)	7.3 (6.3)	.012
FG: too introverted/socially avoiding	14.1 (7.9)	9.5 (7.9)	.020
HI: too insecure/submissive	14.7 (9.3)	12.9 (7.8)	.214
JK: too exploitable/yielding	14.4 (7.5)	12.4 (7.6)	.177
LM: too caring/amicable	14.2 (5.8)	13.0 (7.6)	.308
NO: too expressive/pushy	7.7 (5.3)	8.1 (6.4)	.498
IIP total	11.6 (4.73)	9.4 (5.1)	.001*

\*Level of significance with  $\alpha$ -adjustment for individual scales per questionnaire, sequential Bonferoni correction [Holm 1997]<sup>1</sup> SCL90-R: Symptom Checklist, FKV: Freiburg Disorder-Coping Questionnaire, IIP-D: Inventory of Interpersonal Problems (German version)

Our results are corroborated by another recent study on decompensated tinnitus (Hesse et al. 2001), which also highlighted the importance of paying close attention to organ-related, especially auditory symptoms in addition to psychological symptoms in the evaluation and therapy of tinnitus. The importance of organic factors, especially hearing impairment, found in the current study complements the findings of other authors (Jäger & Lamprecht 2001), who focused more strongly on psychosocial problem constellations as a factor in decompensated tinnitus. As far as audiometric characteristics are concerned, it is noteworthy that results of Hesse et al (2001) and of the current study pointed out that only a small number of patients are using a hearing aid (even though hearing aids have been shown to increase the ability to naturally mask tinnitus by improving the perception of background noise) thus leading to habituation to tinnitus (Hallam 1996, Scott et al, 1990).

According to the present results, the development of decompensated tinnitus could be attributed to cyclically maladaptive psychosomatic processes in which (a) overall morbidity, including auditory impairments, (b) stress in the sense of psychophy-

siological strain, (c) negative coping, and (d) tinnitus decompensation mutually reinforce each other. This hypothesis is currently being followed up by a prospective randomized therapy study involving 200 patients at Halle and Magdeburg universities in Germany.

Finally, similar to the situation found in chronic pain patients (Nickel et al, 2002), the present study calls for a close coordination of treatment efforts in decompensated patients between specialists in audiology, internal medicine, and psychosomatics. Such integrated multidimensional treatment schedules allow one to similarly address the somatic disorders diagnosed and to attend to psychosocial conflicts and problems thereby promoting successful coping strategies.

### Acknowledgements

For his support in collecting the data used for the present study, we thank Dr. J. Müllender, chief physician at the Department of Neurological Psychosomatics, Westerwaldklinik Waldbreitbach. We are furthermore grateful to Frau Professor Dr. G. H. Franke,

**Table 5.** Significant results in the comparison of men and women for the variables of somatic and psychiatric comorbidity, structured tinnitus anamnesis, and the psychometric questionnaires

	Males (n=41)	Females (n=12)	p
Psychiatric disorders			
Affective disorders: N (%)	12 (29.3)	0 (0)	* <sup>1</sup>
Somatic disorders			
Hypoacusis: N (%)	36 (87.8)	7 (58.3)	* <sup>1</sup>
STA			
Able to divert attention: N (%)			
never or very seldom	21 (51.2)	1 (8.3)	** <sup>1</sup>
sometimes	11 (25.8)	4 (33.3)	
often	3 (7.3)	4 (33.3)	
very often	2 (4.9)	3 (25.0)	
always	4 (9.8)	0 (0)	
Able to mask: N (%)			
never or very seldom	20 (48.8)	2 (16.7)	** <sup>1</sup>
sometimes	12 (29.3)	6 (50.0)	
often	4 (9.8)	0 (0)	
very often	1 (2.4)	4 (33.3)	
always	4 (9.8)	0 (0)	
VAS 3 [0–100]			
Limitation on activities: M (SD)	49.6 (27.7)	32.0 (29.4)	* <sup>2</sup>
TF			
Sleep disorders: M (SD)	4.6 (2.3)	3.0 (2.4)	* <sup>2</sup>
IIP-D			
too exploitable /yielding: M (SD)	47.2 (8.8)	56.7 (10.6)	** <sup>2</sup>

Level of significance <sup>1</sup>(bilateral), <sup>2</sup>(unilateral), <sup>3</sup>with  $\alpha$ -adjustment for individual scales per questionnaire, sequential Bonferroni correction [Holm 1997]: \*p < =0.05, \*\*p < =0.01

STA: Structured tinnitus anamnesis, TF: Tinnitus Questionnaire, IIP-D: Inventory of Interpersonal Problems (German Version)

Hochschule Magdeburg-Stendal (FH) and Professor Dr. B. Strauß, University of Jena. The Tinnitus Research Unit of the Department of Psychosomatic Medicine and Psychotherapy, Otto-von-Guericke-University Magdeburg receives financial support from the Saxony-Anhalt Ministry of Education, Science and Culture [Kultusministerium], FKZ: 3423B/0102M.

## References

Andersson, G. 2002. Psychological aspects of tinnitus and the application of cognitive-behavioral therapy. *Clin Psychol Rev*, 22, 977–990.

Budd, R.J. & Pugh, R. 1996. Tinnitus coping style and its relationship to tinnitus severity and emotional distress. *J Psychosom Res*, 41, 327–335.

Delb, W., D'Amelio, R., Schonecke, O.W., & Iro, H. 1999. Are there psychological or audiological parameters determining tinnitus impact? *Psychoacoustics*. Sixth International Tinnitus Seminar, 446–451.

Dineen, R., Doyle, J. & Bench, J. 1997. Audiological and psychological characteristics of a group of tinnitus sufferers, prior to tinnitus management training. *Br J Audiol*, 31, 27–38.

Eggermont, J.J. 1990. On the pathophysiology of tinnitus: a review and peripheral model. *Hear Res*, 48, 111–124.

Erlandsson, S.I. & Hallberg, L.R. 2000. Predictions of quality life in patients with Tinnitus. *Br J Audiol*, 34, 11–20.

Erlandsson, S.I. & Holgers, K.M. 2001. The impact on health-related quality of life with aspects of gender. *Noise Health*, 3, 39–51.

Fichter, M. & Goebel, G. 1996. *Psychosomatische Aspekte des chronischen komplexen Tinnitus*. Dt Ärztebl, 93, A1771–A1776.

Franke, G.H. 1995. Die *Symptomcheckliste von Derogatis SCL-90-R* – GermanVersion- Manual. Göttingen: Beltz Test.

Gefken, R. & Kurth, H. 1992. Psychische Belastung durch Ohrgeräusche. Ergebnisse einer Umfrage bei Personen mit chronischem Tinnitus. In G. Goebel (ed.), *Ohrgeräusche. Psychosomatische Aspekte des komplexen chronischen Tinnitus*. Munich: Quintessenz, pp. 53–64.

Goebel, G. & Hiller, W. 1998a. *Tinnitusfragebogen (TF). Ein Instrument zur Erfassung von Belastung und Schweregrad bei Tinnitus*. Handanweisung. Bern, Toronto, Seattle: Hogrefe.

Goebel, G., Hiller, W. 1998b. *Strukturiertes Tinnitus-Interview (STI). Klinik Roseneck, Priem am Chiemsee*. Hallam, R.S. 1996a. Manual of the Tinnitus Questionnaire (TQ). London: Psychological Corporation.

Hallam, R.S. 1996. *Leben mit Tinnitus. Wie Ohrgeräusche erträglicher werden*. München: Quintessenz.

Harrop-Griffiths, J., Katon, W., Dobie, R., Sakai, C. & Russo, J. 1987. Chronic tinnitus: Association with psychiatric diagnoses. *J Psychosom Res*, 31, 613–621.

Hartkamp, N. 1986. *Patientenfragebogen*. Klinische Dokumentation der Klinik für Psychosomatische Medizin und Psychotherapie der Heinrich Heine Universität Düsseldorf.

Hazell, J.W. & Jastreboff, P. 1990. Tinnitus I. Auditory mechanisms: a model for tinnitus and hearing impairment. *J Otolaryngol*, 19, 1–5.

Henry, J., Wilson, P. 2000. Psychological management of tinnitus. In R. S. Tyler (ed.) *Tinnitus handbook*. San Diego: Singular. Thomson Learning, pp. 263–279.

Hesse, G., Rienhoff, N.K., Nelting, M. & Laubert, A. 2001. Chronic complex tinnitus: therapeutic results of inpatient treatment in a tinnitus clinic. *Laryngol Rhinol Otol*, 80, 503–508.

Hiller, W., Janca, A. & Burke, K.C. 1997. Association between tinnitus and somatoform disorders. *J Psychosom Res*, 43, 613–624.

Holm, S. 1997. A simple sequentially rejective multiple test procedure. *Scand J Stat*, 6, 65–70.

Horowitz, L.M., Strauß, B., & Kordy, H. 2000. *Inventar zur Erfassung Interpersonaler Probleme* – GermanVersion-Manual, 2nd ed. Göttingen: Beltz Test.

Jäger, B. & Lamprecht, F. 2001. Subgroups of styles of coping with chronic tinnitus: a cluster-analytic taxonomy. *Z Klin Psychol Psych*, 30, 1–9.

Jastreboff, P.J. 1995. Tinnitus as Phantom Perception: Theories and Clinical Implications. In J.A. Vernon & A.R. Møller (eds.) *Mechanisms tinnitus*. Boston, London, Toronto: Allyn and Bacon.

Kröner-Herwig, B., Frenzel, A., Fritsche, G., Schilkowsky, G. & Esser, G. 2003. The management of chronic tinnitus of an outpatient cognitive-behavioural group training to minimal contact interventions. *J Psychosom Res*, 54, 381–389.

Lenarz, T. 1992. Allgemeine Diagnostik und Differentialdiagnose. In H. Feldmann (ed.), *Tinnitus*. Stuttgart, New York: Thieme, pp. 76–82.

Lenarz, T. 1998a. Tinnitus guideline. German Society for Ear, Nose and Throat medicine, Head and Neck Surgery. *Laryngol Rhinol Otol*, 77, 531–535.

Lenarz, T. 1998b. Diagnosis and therapy of tinnitus. *Laryngol Rhinol Otol*, 77, 54–60.

Marciano, E., Carraba, L., Giannini, P., Sementia, C., Verde, P., et al. 2003. Psychiatric comorbidity in a population of outpatients affected by tinnitus. *Int J Audiol*, 42, 4–9.

Mertin, M. & Kröner-Herwig, B. 1997. Tinnitus aus psychologischer Sicht. In B. Kröner-Herwig (ed.), *Psychologische Behandlung des chronischen Tinnitus*. Weinheim: Beltz, pp. 15–21.

Møller, A.R. 1984. Pathophysiology of tinnitus. *Ann Otol*, 93, 39–44.



- Muthny, F.A. 1989. *Freiburger Fragebogen zur Krankheitsverarbeitung (FKV)*. Manual. Weinheim: Beltz Test.
- Nickel, R., Egle, U.T. & Schwab, R. 2002. Diagnostic Subgroups and Psychosocial Characteristics in Chronic Non-Malignant Pain Patients Referred to an Out-Patient Pain Center. *Psychother Psych Med*, 52, 378–385.
- Rief, W. & Nanke, A. 2003. Psychologische Grundkonzepte der Verhaltensmedizin. In U. Ehlert (ed.), *Verhaltensmedizin*. Berlin, Heidelberg, New York: Springer, pp. 95–132.
- Schächinger, H. 2003. Herz-Kreislauf-Erkrankungen. In U. Ehlert (ed.), *Verhaltensmedizin*. Berlin, Heidelberg, New York: Springer, pp. 225–263.
- Schepank, H. 1995. BSS. Der Beeinträchtigungs-Schwere-Score. *Ein Instrument zur Bestimmung der Schwere einer psychogenen Erkrankung*. Manual. Göttingen: Beltz Test.
- Schonecke, O. W. & Herrmann, J. M. 1996. Psychophysiologie. In Uexküll, Th. v. (ed.), *Psychosomatische Medizin*, 5. erw. Aufl., München, Wien, Baltimore: Urban und Schwarzenberg, pp. 161–197.
- Scott, B., Lindberg, P., Mellin, L & Lyttkens, L. 1990. Predictors of tinnitus discomfort, adaption and subjektive loudness. *Br J Audiol*, 24, 51–62.
- Scott, B. & Lindberg, P. 2000. Psychological profile and somatic complaints between help-seeking and non-help-seeking tinnitus subjects. *Psychosomatics*, 41, 347–352.
- Sullivan, M.D., Katon, W., Russo, J., Dobie, R. & Sakai, C. 1988. Disabling tinnitus. Association with affective disorders. *Gen Hosp Psychiatry*, 10, 285–291.
- Svitak, M. 1998. 'Psychosoziale Aspekte des chronisch dekompenzierten Tinnitus. Psychische Komorbidität, Somatisierung, dysfunktionale Gedanken und psychosoziale Beeinträchtigung'. Dissertation: Naturwissenschaftliche Universität Salzburg.
- Winter, B., Nieschalk, M. & Stoll, W. 1996. Effects of relaxation therapy as group and individual treatment of chronic tinnitus. *Psychother Psych Med*, 46, 147–152.