

Beneficial Efficacy during Bedtime Sleep by Small Music Player “Lullaby Reverberation”

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Abstract

Effect of music on sleep quality was studied. Subjects were 15 female aged 40s-70s, and received listening to music when going to sleep every night using sound sleep support sound player. It is Lullaby reverberation (Komoriuta-no-Hibiki) and the protocol continued 8 weeks with evaluation of Athens Insomnia Scale (AIS). Total average AIS point was 4.6 and 3.1 in 0 and 8 weeks, respectively. For natural sound such as water, wave and wind, positive (n=3) and negative (n=3) responses were found. For favorite music, positive (n=4) and negative (n=0) responses are found. Consequently, music brought beneficial effect for sleep quality.

Keywords: Athens Insomnia Scale (AIS); Music therapy; Sound sleep support sound player; Lullaby reverberation; Bedtime sleep

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Introduction

From medical and social points of view, current society has given many people a variety of stressful matter for long [1]. For adequate management of patients with various diseases and impairment, psychosomatic medicine, primary care (PC) medicine and Integrative Medicine (IM) have been in focus until now [2]. Authors and co-researchers have continued medical and art research concerning psychosomatic medicine, music therapy, art therapy, psychology, holistic medicine, IM, lifestyle-related disease, and so on [3,4]. We have managed Integrative Medicine Japan (IMJ), Shikoku Island division, Japan for years [5,6]. Especially, authors reported several articles for music therapy and psychology [7,8].

For treating sleep disturbance, pharmacotherapy and non-pharmacological approaches have been found. The latter includes limiting daytime naps, avoiding caffeine at night, mindfulness, acupuncture, cognitive behavioral therapy for insomnia (CBTI) and music-based intervention [9]. Among them, music therapy has been accepted widely for long years. Formal music intervention would be psychologically evidence-based actual treatment [10]. The purpose includes the supportive development of health and well-being of an individual [11]. Sleep disturbance or insomnia has been common symptom and problem. From previous studies, about 30-70% of elderly people seem to have impaired sleep situation [12]. Several kinds of medical problems are found for the comorbidity such as meal content, exercise and various stressors in the lifestyle [13].

Music interventions show various beneficial function. The effect of music on sleep quality was investigated by some internet search, using PubMed, Embase, the Cochrane Library, and Web of Science

[14]. The methodological approach adopted random effects models and effect measure (MD). As a result, 9 studies with 489 cases were included and music interventions showed a positive effect on sleep quality as MD = -2.64 p<0.001. Especially, efficacy was found in sleep duration, latency and efficiency as well as daytime dysfunction of sleep in older cases.

Music is not only entertainment matter but also a self-tool to improve sleep disturbance. For evaluating the efficacy of bedtime music, the research of RCT was conducted [15]. Totally 57 cases with insomnia were analyzed for three groups, which were music intervention, audiobook control or waitlist control. As a result, listening bedtime music seems to show positive influence for sleep perception and QOL, but clear effect was not clear for insomnia severity. Music can be used for easy and safe tool, but further study will be required to clarify music efficacy on some insomnia subtype for preventive and adjunctive intervention.

Currently, authors had an opportunity of project to study music effect during sleep condition. The applicants were female staffs of medical area, and their psychosomatic influence was checked by Athens Insomnia Scale (AIS). The general results and discussion are shown in this article.

Subjects and Methods

Subjects enrolled in the current the subjects are 15 females, who are from 40s to 70s. There average age was 61.6 +/- 11.6 years old (mean +/- standard deviation). As to their characteristic background, they were medical staffs or related person in our research groups of medicine, music therapy, primary care and integrative medicine associations. They are selected for some reasons that i) they can lead almost regular life, ii) they can go to sleep regularly for listening to music every night, iii) they do not

have young children in the home with possibly unexpected management or events at night.

Methods include the project of listening to music as the research of music therapy. We applied a sound sleep support sound player “Lullaby reverberations”, which name is “komoriuta no hibiki (sound of lullaby) “. It was produced by the collaboration project of Avex for health and sound space composer [16,17]. Its shape is a small cubic about 9 cm each in size (Figure 1).



Figure 1: Lullaby reverberations.

This instrument has more than 60 kinds of music, such as lullaby, classic music, popular music, nature sound of water, waves, wind and others. The applicants listened the music along with the protocol.

Athens Insomnia Scale (AIS)

Athens Insomnia Scale (AIS) has been evaluated as useful diagnostic test for sleep disturbance [18]. It has 8 aspects, which are summarized in (Table 1).

Table 1: Eight factors of AIS.

Eight factors of AIS
Sleep induction
Awakenings during the night
final awakening
total sleep duration
sleep quality
well-being
functioning capacity
sleepiness during the night

AIS was shown for its reliability, consistency and validity, where 299 subjects were assessed associated with the international standard diagnosis of ICD-10 [19]. When diagnosing various person with adequate threshold of the score, it showed high reliability associated with 93% of sensitivity and 85% of specificity. This situation represents the beneficial usefulness of correct case identification in 90% overall level.

Our protocol of the project includes i) the application of well-known questionnaire of sleep disturbance, which is Athens Insomnia Scale (AIS). The applicants were requested to listen to music during going to sleep every night for 8 weeks. In the last day of each week (1-8 week), they were to write in the questionnaire of AIS. The schedule is shown in (Table 2).

Table 2: Protocol of music and AIS questionnaire.

Week (wks)	Music type (in the music box)	Answer AIS (weekend)
1	no music listened 7 days	AIS for 1 week
2	No. 1-46: classic music	AIS for 2 week
3	No.47-54: nature sound	AIS for 3 week
4	No.55-65: lullaby music	AIS for 4 week
5	No. 1-46: classic music	AIS for 5 week
6	No.47-54: nature sound	AIS for 6 week
7	No.55-65: lullaby music	AIS for 7 week
8	applicant's favorite music	AIS for 8 week

Results

Table 3: The Results of intervention of music therapy by AIS.

Case number (No.)	Age (M/F (Years))	Total Points		Nature Sound		Start Effect		Favourite Music	
		0 Week (pts)	8 Weeks (pts)	Positive (pts/pts)	Negative (pts/pts)	Positive (pts/pts)	Negative (pts/pts)	Positive (pts/pts)	Negative (pts/pts)
1	42F	3	4	10/2			3/10		
2	46F	8	12		7/13	8/5			
3	51F	7	1	15/3			7/15	4/1	
4	52F	7	4					6/4	
5	55F	0	0						
6	57F	8	1		4/7	8/4			
7	60F	4	1					3/1	
8	61F	4	3						
9	63F	4	3		2/5		4/7		
10	64F	1	0						
11	65F	8	5						
12	75F	3	2			3/0			
13	76F	1	0						
14	78F	3	6				3/6		
15	79F	8	5	11/7			8/11	7/5	

1. Comparison: The total points of 0 weeks and 8 weeks in 15 cases were compared (Table 3). For the positive responses, 6 cases had an improvement of 3 points or more, 5 cases had an improvement of 1-2 points, 1 case had no change, and 3 cases had a negative reaction (1, 3, and 4 points each). Total points for 15 patients at 1 and 8 weeks were 4.6 +/- 2.8 and 3.1 +/- 3.2 (mean +/- SD). Regarding the data from 1 to 8 weeks, the changes in two weeks were assessed as follows. They are i) start effect is from 1 to 2 week, ii) nature sound influence is 3 to 4 week and 6 to 7week, and iii) favorite music 7 to 8 week. Otherwise, obtained data did not show any changes.
2. Natural sounds: Responses were roughly divided into three groups. Relaxation (positive response) to natural sounds was found in 3 cases, and conversely, negative response was found in 3 cases. The other 9 cases showed the changes within 2 points. In addition, 3 younger cases showed larger degree of positive or negative reaction.
3. Start effect: As to the current protocol of listening to music at bedtime, the participants did not listen for the first week and started listening to music from the second week. The changes from 1st to 2nd week showed the starting effect or influence of listening to the music. As a result, positive beneficial response was found in 3 cases. On the other hand, 5 cases showed a negative reaction, in which 2 cases from them were in their 70s.
4. Favorite music: In the 8th week, each subject chose their favorite music. Improvement of 2 points or more was observed in 4 out of 15 cases. On the other hand, there were no cases of negative response to favorite music.

Discussion

For recent decade, sleep quality has been a crucial clinical matter because it becomes increasingly common problem for many people. They complain of poor quality of sleep and related influence on daytime working. Indeed, there are some detail exams for sleep problems, but they are time-consuming, expensive and not practical for research investigation [20]. Among these circumstances, some psychometric questionnaires have been introduced. They include Pittsburgh Sleep Quality Index (PSQI) [21], Athens Insomnia Scale (AIS) [22], Insomnia Severity Index (ISI) [23], Mini-Sleep Questionnaire (MSQ) [24], Jenkins Sleep Scale (JSS), Leeds Sleep Evaluation Questionnaire (LSEQ), SLEEP-50 Questionnaire, and Epworth Sleepiness Scale (ESS) [25]. As systematic literature search was conducted during 2008-2020, totally 5734 papers were found. Among them, 49 articles were selected and analyzed for their detail study [20].

The comparison of AIS and PSQI has been reported. PSQI has been evaluated as the beneficial battery for diagnosing sleep disturbance. When PSQI is set for the standard method for diagnosing sleep problem, the following validity is observed for AIS method as follows: sensitivity (76.9%), specificity (91.0%), positive predictive value (PPV) (81.1%), and negative predictive value (NPV) (88.8%). If the subjects are in the medicated group, the four factors of the AIS method showed 100%, 70%, 78.6%, 100%, respectively. Compared with PSQI, AIS is rather simple and convenient for clinical actual use. Consequently, the application of AIS would become an alternative questionnaire in comparison with PSQI [26].

Recently, the validation of AIS was studied by two useful measures of rating scale model and classical theory [27]. The subjects were 563 nurses actually working with the age of 33.2 +/- 7.1 years old for cross-sectional study. As a result, satisfactory values (above

0.95) were found by incremental fit index (IFI) and comparative fit index (CFI). Consequently, AIS seems to show adequate reliability, validity and item properties. Sleep disturbance has been common and crucial health problem. It links to impaired performance and decreased well-being for people. For diagnosis of sleep problems, several tests have been known. Among them, AIS seems to be useful for not only clinical purpose, but also non-clinical application (AIS-NCA) [28].

From the current results, some perspectives could be observed. Four aspects are described in this order as follows: Firstly, clinical effect of music at bedtime was compared between 0 and 8 weeks. The average value of the data decreased from 4.6 to 3.1 points, suggesting an improvement in various symptoms. A positive reaction was observed in 11 cases, no change in 1 case, and a negative effect in 3 cases. In negative cases, long-term rather than short-term music listening would lead to progressively positive responses to sleep. Two cases in their 40s and 1 case in their 70s had negative reactions. On the other hand, most cases in 50s and 60s showed beneficial response.

Secondly, natural sounds such as water, waves, and wind seem to respond differently depending on the case. It is well-known that ordinary music has melodies, rhythms, and chords. Thus, it is judged as a sound that can be expressed numerically by digital values. In contrast, natural sounds are different. These are difficult to measure with ordinary musical concepts and standards, and some people may perceive them as noise rather than sound. In fact, a total of 3 people, 2 young people and 1 elderly person, showed a positive reaction for this study. They seemed to feel comfortable. However, 3 cases showed a negative reaction, and 9 cases showed no change. In this way, it was suggested that the preference and reaction to natural sounds in a quiet environment at bedtime may differ depending on the case.

Thirdly, subjects started listening to the music from 2nd week. When compared with 1 to 2 week, 3 cases showed positive reactions after starting listening to the music. Conversely, 5 cases showed negative reactions, in which 2 cases were in their 70s. These changes seemed to be short-term influence, and the subsequent process suggested that such response would be disappeared over medium to long term.

Fourthly, in the final week, each subject chose their favorite music in the final week [29]. As a result, 4 cases showed positive responses with no case with negative responses. From previous reports on music therapy, many people can feel easy for familiar and favorite music [30]. Our current results seemed to be consistent to the situation.

Some limitations are present in the current investigation. Subjects were for 40-70s and they are female staffs from medical practice and research group. The project was conducted completely. However, the number of the subjects were not small range, and the questionnaire of AIS adopted the system of 0,1,2,3 points according to each subjective feeling. In the future, more detail research method will be recommended. Furthermore, research area would be widely selected such as health care facility, hospital, clinic, nursing home, welfare facilities, and complementary and

alternative medicine (CAM) related association [31].

In summary, we have investigated the effect of music on sleep situation in the current study. The musical apparatus, small sound sleep support sound player seemed to be beneficial for middle to elderly female. The obtained results will be further evaluated with future protocol projects. We hope this paper will be useful data for research development.

Conflict of Interest

None

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References

1. Hastings BC, Fadiman J, Gordon JS. *Health for the Whole Person: The Complete Guide to Holistic Medicine*. 2019; 548.
2. Fritzsche K, Goli F, Dobos CM. *What Is Psychosomatic Medicine? Psychosomatic Medicine*. 2020; 3-16.
3. Bando H. Clinical efficacy of sedative music for sleep disturbance in elderly people. *Int J Complement Alt Med*. 2022; 15: 248-249.
4. Tanaka K, Nagahiro S, Bando H. Beneficial Art in Hospitals with Masking Tape Initiated from University Hospital. *Asp Biomed Clin Case Rep*. 2020; 3: 202-205.
5. Nishikiori Y, Bando H, Yoshioka A. Basic Function of Sensory-Motor Transformations for Music Activity Associated with Human Six Senses. *SunText Rev Arts Social Sci*. 2022; 3: 132.
6. Hirai Y, Bando H, Yoshioka A, Nishikiori Y. *Music and Man in Art: The Future of Media and Technology*. *Global J Arts Social Sci*. 2020; 2: 116.
7. Bando H, Yokoyama T. Characteristic Egogram Pattern in University Students Using Tokyo University Egogram (TEG). *Res J Sport Health Psychol*. 2021; 3: 115.
8. Yokoyama T, Bando H. Transactional analysis shows child factor would be influential egogram for late teenager. *Edelweiss Psy Open Access*. 2021; 5: 7-9.
9. Edinger JD, Arnedt JT, Bertisch SM, Carney CE, Harrington JJ, Lichstein KL, et al. Behavioral and psychological treatments for chronic insomnia disorder in adults: an American Academy of Sleep Medicine clinical practice guideline. *J Clin Sleep Med*. 2021; 17: 255-262.
10. British Association for Music Therapy. *What is music therapy?* 2019.
11. American Music Therapy Association. *Definition and quotes about music therapy*. 2018.
12. Praharaj SK, Gupta R, Gaur N. *Clinical Practice Guideline on Management of Sleep Disorders in the Elderly*. *Indian J Psychiatry*. 2018; 60: 383-396.
13. Sutanto CN, Loh WW, Toh DWK, Lee DPS, Kim JE. Association between Dietary Protein Intake and Sleep Quality in Middle-Aged and Older Adults in Singapore. *Front Nutr*. 2022; 9: 832341.
14. Wang C, Li G, Zheng L, Meng X, Meng Q, Wang S, et al. Effects of music intervention on sleep quality of older adults: A systematic review and meta-analysis. *Complement Ther Med*. 2021; 59: 102719.
15. Jespersen KV, Otto M, Kringelbach M, Van Someren E, Vuust P. A randomized controlled trial of bedtime music for insomnia disorder. *J Sleep Res*. 2019; 28: 12817.
16. Random Cube. *Avex for health*.
17. Hiroaki Ide. *Sound Space Composer*.

18. Soldatos CR, Dikeos DG, Paparrigopoulos TJ. Athens Insomnia Scale: validation of an instrument based on ICD-10 criteria. *J Psychosom Res.* 2000; 48: 555-60.
19. Soldatos CR, Dikeos DG, Paparrigopoulos TJ. The diagnostic validity of the Athens Insomnia Scale. *J Psychosom Res.* 2003; 55: 263-267.
20. Fabbri M, Beracci A, Martoni M, Meneo D, Tonetti L, Natale V. Measuring Subjective Sleep Quality: A Review. *Int J Environ Res Public Health.* 2021; 18: 1082.
21. Doi Y, Minowa M, Uchiyama M, Okawa M, Kim K, Shibui K, et al. Psychometric assessment of subjective sleep quality using the Japanese version of the Pittsburgh Sleep Quality Index (PSQI-J) in psychiatric disordered and control subjects. *Psychiatry Res.* 2000; 97: 165-72.
22. Deng M, Qian M, Ly J, Guo C, Yu M. The association between loneliness and sleep quality among older adults: A systematic review and meta-analysis. *Geriatr Nurs.* 2023; 49: 94-100.
23. Okajima I, Miyamoto T, Ubara A, Omichi C, Matsuda A, Sumi Y, et al. Evaluation of Severity Levels of the Athens Insomnia Scale Based on the Criterion of Insomnia Severity Index. *Int J Environ Res Public Health.* 2020; 17: 8789.
24. Kim HJ. Validation of the Korean Version of the Mini-Sleep Questionnaire-Insomnia in Korean College Students. *Asian Nurs Res (Korean Soc Nurs Sci).* 2017; 11: 1-5.
25. Walker NA, Sunderram J, Zhang P, Lu SE, Scharf MT. Clinical utility of the Epworth sleepiness scale. *Sleep Breath.* 2020; 24: 1759-1765.
26. Kawaratani H, Miyaaki H, Hiraoka A, Nakao K, Hiasa Y, Yoshiji H, et al. The Usefulness of the Athens Insomnia Scale for Evaluating Sleep Disturbance in Patients with Chronic Liver Disease Comparing with Pittsburgh Sleep Quality Index and Epworth Sleepiness Scale. *Medicina (Kaunas).* 2022; 58: 741.
27. Manzar MD, Albougami A, Hassen HY, Sikkandar MY, Pandi-Perumal SR, Bahammam AS. Psychometric Validation of the Athens Insomnia Scale Among Nurses: A Robust Approach Using Both Classical Theory and Rating Scale Model Parameters. *Nat Sci Sleep.* 2022; 14: 725-739.
28. Sattler S, Seddig D, Zerbini G. Assessing sleep problems and daytime functioning: a translation, adaption, and validation of the Athens Insomnia Scale for non-clinical application (AIS-NCA). *Psychol Health.* 2021; 12: 1-26.
29. Otera M, Saito S, Kno H, Ichie M. Clinical characteristics of home-based music therapy in supporting personhood in people with dementia. *The Arts in Psychotherapy.* 2020; 70: 101682.
30. Sexton S. Enhancing the Quality of Life for Senior Citizens: A Facilitators Guidebook for Mindful Music and Movement. *Mindfulness Studies Theses.* 2023.
31. Ding J, Huang T, Hu J, Yuan F. Effectiveness and safety of music therapy for insomnia disorder patients: A protocol for systematic review and meta-analysis. *Medicine (Baltimore).* 2021; 100: 26399.