



Original Article

Acoustic music therapy on improving cognitive function and sleep quality in elderly dementia patients

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ABSTRACT

Background: Acoustic music therapy has been shown to have an impact on reducing anxiety and stress, but not specifically on various stages of dementia and sleep quality in the elderly. This research could explore how acoustic music therapy can provide similar benefits in elderly patients with dementia, where sleep and quality of life problems are often primary concerns.

Objective: To determine the effect of acoustic music therapy on improving cognitive function and sleep quality in elderly dementia patients.

Method: A pre-experimental design employing a one-group pretest-posttest without a control group was utilized. The sampling method employed was purposive sampling, involving 30 selected respondents. The paired sample t-test was then applied for the statistical analysis.

Results: The average dementia score among the elderly increased by 4.36 points (16.17 ± 5.53 to 20.53 ± 4.14) after the intervention. Similarly, the average score for sleep disorders decreased by -0.4 points (7.07 ± 3.11 to 6.67 ± 1.92). The statistical analysis indicated a significant influence of acoustic music on dementia disorders in elderly individuals with sleep disorders ($p < 0.0001$). However, acoustic music did not affect sleep disorders in the elderly ($p > 0.05$).

Conclusion: Acoustic music therapy benefits the elderly, particularly in managing dementia and sleep disorders. These findings emphasize the potential of music therapy as a valuable non-pharmacological alternative in the overall care of the elderly.

INTRODUCTION

Declining cognitive function in the elderly impacts decreasing daily social activities, becoming unproductive, giving rise to public health problems, and increasing financing of family, society, and government.¹ Along with the increase in the number of older adults, there is also an increase in the population with dementia. Approximately 60-70% of cases are attributed to Alzheimer's dementia, a degenerative disease characterized by a decline in brain function.¹ This condition impacts various aspects such as emotions, memory, decision-making, behavior, and other cognitive functions, ultimately disrupting daily activities.²

In 2015, it was estimated that 47.5 million people worldwide had dementia, with 22 million in Asia and over 4 mil-

lion in the United States suffering from Alzheimer's disease; by 2050, the number is predicted to quadruple.³ Low and middle-income countries account for about 58% of cases, and this number is expected to rise to 71% by 2050.⁴ A new dementia case occurs every 4 seconds, resulting in a total of 7.7 million cases globally annually. It is estimated that there will be a growth of 75.6 million cases by 2030 and 135.5 million by 2050. Alzheimer's affected one million people in Indonesia in 2013, with projections to double by 2030 and reach four million by 2050, indicating a consistent upward trend in Alzheimer's cases.¹

Dementia can be distinguished by a variety of symptoms, such as impaired memory, diminished arithmetic skills, and decreased spontaneous activity, along with disorientation and language disorders like aphasia.¹ Individuals who experience it face confusion, severe memory decline

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that hinders task completion, significant self-care difficulties, disrupted sleep cycles, incontinence, loss of familial recognition, and repetitive actions.⁵ During advanced stages, sleep disturbances become more prevalent. Additional symptoms include confusion, language difficulties, communication challenges, problem-solving issues, personality changes, and motor coordination struggles, varying severity and progression.⁶

Effective management is only possible through early diagnosis and appropriate care. Those with dementia also experience sensitivity to environmental sounds, with some experiencing a loss of accurate interpretation despite the possibility of hearing loss.^{7,8} The prevention of confusion, illusions, frustration, and agitation caused by excessive noise is crucial with careful sound management.⁹

An effective way to address sleep disorders in the elderly is to create a comfortable and peaceful sleeping environment. Non-pharmacological therapies, such as music therapy, particularly Physio Acoustic Sound (PAS) therapy, have significantly improved sleep quality and overall well-being.^{7,8} In Finland, the development of music acoustic physio involves connecting unique chairs or beds to a PC that produces low-frequency sound waves, impacting various body functions, including the brain's control center, the thalamus, nerve tissue, muscles, and circulation. Acoustic physio music can reduce muscle tension, improve blood flow, and alleviate pain. PAS therapy has proven effective in overcoming nocturnal problems in dementia patients and addressing issues such as stress, stiffness, and pain in various conditions, including autism and personality disorders.⁹⁻¹¹

Although acoustic music therapy has been proven to impact the reduction of cognitive function, there is still limited research specifically exploring its effects on various stages of dementia and sleep quality in the elderly. The uniqueness of this research lies in its focus on elderly patients with dementia, where sleep and quality of life issues are often primary concerns. This research aims to determine the effect of acoustic music therapy on improving cognitive function and sleep quality in elderly dementia patients.

METHOD

Study Design

This study uses a pre-experimental design with a pre-test and post-test in a group without a control group.

Setting and Respondents

The study focuses on the elderly living in Sudagaran Banyumas Elderly Social Services, consisting of 83 elderly. The researcher employs a purposive sampling technique to ensure a targeted sample, carefully selecting par-

ticipants based on predetermined inclusion criteria. The elderly who lack cooperation or are in an unwell condition/undergoing treatment are not included in this study, so 30 elderly meet the criteria. This method allows for the deliberate selection of samples, considering specific factors determined by the researcher and the recognized characteristics of the population under study.¹²

Experimental Procedure

The initial steps involved the preparation of essential tools and materials, including questionnaires, mobile phones, and earphones. The data collection process commenced with administering a dementia measurement questionnaire before the intervention. Upon completing this measurement, the participants were exposed to the therapeutic intervention of acoustic music physiotherapy. The second measurement was carried out after a lapse of seven days following the commencement of acoustic music physiotherapy, allowing for an assessment of the sustained effects and changes over this one week. This sequential approach in data collection ensured a comprehensive evaluation of the impact of acoustic music physiotherapy on the participants' dementia-related outcomes.^{7,8,10}

Variables, Instruments, and Measurements

This study's data collection process consisted of two phases, with assessments conducted before and after acoustic music physiotherapy.^{12,13} The researcher administered a comprehensive questionnaire designed to explore various aspects of dementia systematically during the initial phase of acoustic music physiotherapy. The questionnaire was carefully crafted and utilized established criteria to capture subtle insights into the cognitive aspects of dementia.^{7,14} The researcher employed the Mini-Mental State Examination (MMSE), a widely recognized and standardized tool celebrated for its reliability in meticulously assessing cognitive capabilities to delve further into the participants' cognitive functions.¹³ The comprehensive nature of this tool allowed for a complete examination of the cognitive landscape, providing valuable insights into the participants' mental states.

The assessment of sleep quality was crucial to gain a comprehensive understanding of the study's scope. The Pittsburgh Sleep Quality Index (PSQI) was chosen as the instrument used to achieve this.^{15,16} Renowned for its efficacy in evaluating not only the quality but also the intricate patterns of sleep, the PSQI emerged as a robust and versatile means of delving into the multifaceted dimensions of sleep within the context of the research. The selection of these instruments demonstrates a methodological rigor that aims to gain a nuanced and comprehensive understanding of the cognitive and sleep-related aspects discussed in this study.

Statistical Analysis

The paired t-test was chosen as the statistical method to conduct a comparative analysis of dementia scores and sleep quality, meticulously examining their fluctuations before and after the implementation of acoustic music physiotherapy.¹⁷

Ethical Consideration

This comprehensive research endeavor underwent a rigorous evaluation process. It was granted ethical approval by the Research Ethics Committee of Muhammadiyah University Purwokerto, as denoted by the official reference number KEPK/UMP/29/IV/2019. This ethical approval, emblematic of the commitment to upholding research integrity and ethical standards, was officially bestowed upon the study on the 23rd day of April 2019. The meticulous scrutiny and endorsement by the Research Ethics Committee affirm the adherence to ethical principles and the conscientious pursuit of knowledge in the scholarly pursuit conducted by the researchers involved in this study.

RESULTS

Table 1 provides a detailed depiction of age distribution, gender composition, sleep duration, sleep patterns, and time to fall asleep. Most individuals are 60-74 (60%), gender distribution indicates 63.3% women, average sleep duration is 7.02 hours, and time to fall asleep averages 52 minutes.

Table 2 summarizes cognitive and sleep quality scores for elderly participants before and after an intervention. After the intervention, there was a significant improvement in cognitive scores and sleep quality scores. The observed changes in both variables (cognitive and sleep quality) after the intervention indicate a positive impact. The lower standard deviation after the intervention suggests a better level of consistency in participants' responses to the intervention. These findings offer a comprehensive insight into the cognitive and sleep quality dynamics of the elderly participants, demonstrating the potential impact of the intervention on enhancing cognitive function and improving sleep quality.

The influence of acoustic music on cognition and sleep quality is shown in Table 2, which provides cognitive and sleep quality before intervention. The significant improvement in cognitive scores after the intervention indicates that acoustic music may positively impact cognitive function. Although there was a decrease in the average sleep quality score after the intervention, this change is not statistically significant (>0.05). This analysis suggests that acoustic music intervention may provide positive benefits, especially in the cognitive aspect, even though changes in sleep quality may not be statistically significant.

Table 1. Characteristic of Respondents

Characteristics	Result
Age, years	
35-49	4 (13.3%)
60-74	18 (60%)
75-90	7 (23.3%)
90-120	1 (3.3%)
Gender	
Man	11 (36.7%)
Woman	19 (63.3%)
Sleeping duration, hour	7.02 ± 0.74
Time needed to sleep, minutes	52 ± 23.55

Table 2. Analysis of Differences in Cognitive and Sleep Quality Scores Before and After Acoustic Music Therapy

Variable	Mean ± SD	Mean Diff	p-value
Cognitive			
Before	16.17 ± 5.53	4.37	0.0001
After	20.53 ± 4.14		
Sleep Quality			
Before	7.07 ± 3.11	0.40	0.476
After	6.67 ± 1.92		

DISCUSSION

The research strongly supports the effectiveness of psychoacoustic music intervention as a successful way to improve dementia in the elderly. The implications may stimulate further development in non-pharmacological approaches to dementia management in the elderly population.^{8,17} Dementia significantly declines cognitive function, hindering daily activities and social interactions.^{3,18} In particular, cognitive decline in the elderly often includes decreased memory abilities or recall. Management of dementia involves crucial actions in maintaining the patient's cognitive function and self-esteem.^{5,14}

In dementia treatment, it is essential to understand that treatment strategies can be divided into two main approaches: pharmacological and non-pharmacological. While pharmacological approaches often involve using medications to reduce symptoms, non-pharmacological approaches explore solutions that do not involve medications. One non-pharmacological approach that has gained attention is music therapy.¹⁵ Therapy is not only a promising alternative but also positively contributes to dementia management. Further understanding of how music therapy can be effectively applied in dementia care may provide valuable guidance for developing more comprehensive non-pharmacological methods for addressing the complex challenges associated with this condition.

The results of this study lead us to a deeper understanding of the effects of interventions on sleep disorders in the elderly population. Before the intervention, it was found that

the average sleep disturbance score reached 7.07. However, after the intervention was applied, the average score decreased to 6.67. It is essential to highlight that sleep quality scores did not significantly change following the intervention, despite the quantitative data in Table 3 confirming a statistically significant improvement in cognitive scores. Although acoustic music physiotherapy may help improve cognitive function, the measured outcomes indicate a less significant effect on sleep quality.²¹ This can be interpreted as a challenge or complexity in overcoming sleep disorders in the elderly with the method or approach used. Certain factors, such as individual characteristics, underlying health conditions, or even variability in response to interventions, may play a role in the observed results.

During the research, exciting findings showed that some older adults fell asleep during the intervention. This suggests that the intervention positively impacts the comfort and calm of the studied older adults. Specifically, pleasure and calm were associated with the experience of listening to music provided by the researcher. These findings reflect the potential positive influence of Physio Acoustic Sound Therapy. According to the explanation, physio-acoustic sound therapy allows the body to produce serotonin, a neurotransmitter associated with happiness and relaxation. In addition, this therapy can also contribute to reducing adrenaline levels in the blood, which can generally trigger a stress response.²² With the reducing effects of adrenaline, the body can achieve a better level of relaxation, allowing for more optimal body function.^{10,12}

Furthermore, these findings suggest that using music or sound therapy as part of an intervention for the elderly may be a significant aspect to consider in designing health or care programs specifically for the elderly population.^{9,14,21} By understanding and exploiting sound therapy's potential psychological and physiological benefits, we can create a more holistic and practical approach to improving older adults' quality of life and well-being.

The statistical analysis indicates a significant difference before and after intervention using physio-acoustic music in older adults with sleep disorders ($p < 0.0001$). More technically, a p-value close to zero indicates that the likelihood of this change occurring by chance is very low, strengthening the validity of the findings. The interpretation of these findings is that physio-acoustic music has a positive and significant influence on sleep disorders in older adults with dementia. Music in a therapeutic context is a practical and valuable intervention in managing sleep disorders in this elderly population. These results are consistent with previous research, showing that providing music effectively manages dementia symptoms and psychological aspects in the elderly.⁷

These findings support the concept that music provides entertainment and can be an effective therapeutic tool in alleviating sleep disorders and improving psychological well-being in older people with dementia. Integrating music therapy or physio-acoustic music can be a valuable intervention in designing mental health care and support programs for older people in various care contexts.²³ Listening to music can make the human brain more active in recalling vital memories, which has a strong association with positive effects on memory, especially in individuals with Alzheimer's.⁷ Research and observation have shown that music can activate various brain areas, including those involved in storing and recalling memories.

In individuals with Alzheimer's or other cognitive disorders, where memory abilities are often affected, listening to music can provide unique stimulation.^{7,22} Music can create emotional ties to past memories, which can often trigger positive responses in people with dementia. Through listening to music, especially songs or melodies related to their life experiences, the individual may experience powerful memories and respond with positive emotions. Stimulation of memories through music can also have a significant psychological impact on people with dementia.

Music can be a means to express emotions, improve mood, and evoke positive experiences. This has significant value in the care and support of the mental health of individuals with dementia, as they often face complex emotional and cognitive challenges.⁷ Thus, listening to music is not only a pleasant activity but can also be considered an effective therapy for improving memory and psychological well-being in people with Alzheimer's or similar cognitive disorders. This approach reflects recognition of the power of music in stimulating brain function and stimulating emotional memories, providing a valuable way to support the quality of life of people with dementia.

The results of this study provide a fascinating picture regarding the influence of physio-acoustic music on sleep disorders in the elderly. The analysis results showed no significant difference before and after the intervention using physio-acoustic music ($p > 0.05$). This means that, statistically, the physio's acoustic music intervention did not significantly improve sleep disorders in the elderly studied. However, it should be noted that these results are not in line with previous studies providing that physio-acoustic music effectively overcame sleep problems in patients with dementia. These inconsistencies raise questions about factors that may have influenced study results, such as differences in sample characteristics or intervention methods.²²

The theory states that music can trigger a relaxation response by decreasing the body's need for oxygen, increasing blood flow, the release of calming neurotransmitters, and improving nervous system function. As a result,

the body's muscles become more relaxed, creating a feeling of calm and comfort, making sleeping more accessible for the elderly.⁸ This dissonance between research findings and theory highlights the complexity of understanding the interaction between physio-acoustic music and sleep disorders in older people. Further research is needed to explore the factors that may account for these differences and further understand how physio-acoustic music can be optimized as an intervention tool in managing sleep disorders in the elderly population.

CONCLUSIONS AND RECOMMENDATION

The findings reveal a significant positive effect of acoustic music therapy on dementia disorders among the elderly, as evidenced by a notable increase in the average dementia score post-intervention. Although the average score for sleep problems decreased, this difference was insignificant. These findings imply that acoustic music therapy has the potential to be a successful strategy for treating dementia in the senior citizen community. The noted enhancement in cognitive performance emphasizes how music therapy can benefit the well-being of those facing dementia-related difficulties. Even though the effect on sleep quality did not approach statistical significance in this investigation, the general tendencies point in a good direction and call for more research to enhance comprehension of acoustic music therapy's effects across dementia stages. The study's expansion to diverse demographic backgrounds and dementia stages aims to furnish a comprehensive guide for implementing acoustic music therapy in elderly care, offering a deeper understanding of its holistic effects on overall well-being.

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