SCIENTIFIC FEDERATION
ABODE FOR RESEARCHERS

Kazue Sawami, SF J Geriatrics Pallia Care, 2017, 1:1

SciFed Journal of Geriatrics and Palliative Care

Research Article Open Access

Verification of the Impact of Storage by the Rhythm Phrase to be Repeated

*[1]Kazue Sawami, [2]Mitsuo Kimura, [2]Tetsuro Kitamura, [2]Himeyo Nakagawa

*[1,2]Nara Medical University, Japan

Abstract

Introduction

Alzheimer's Disease (AD) accounts for a high percentage of dementia at over 60%. As dementia incidence doubles every 5 years from 65 years old onwards, developing a countermeasure is an urgent issue. As a countermeasure, the effectiveness of cognitive function training tasks such as dual-task (performing two tasks simultaneously) and n-back task (a delayed recall task for items shown n steps earlier) have been verified. Furthermore, it has been verified lyrics accompanied with sound or rhythm are stored easily by the memory, but difficult to remember when without sound or rhythm. It was hypothesized that combining rhythmic music with repeated memory tasks would improve memory performance. It was also predicted that stress associated with memory tasks would be alleviated by the relaxing effect of music. The purpose of this study is to verify a new training method combining rhythmic music and repeated memory tasks. An intervention study was conducted over 3 months, and compared results from the intervention group and the control group.

Method

Screening test for mild cognitive impairment: Montreal Cognitive Assessment (MoCA test) and; Stress check: Measured α-amylase levels of saliva taken from the sublingual gland. Analysis was conducted by a corresponding t-test, comparing the control group and intervention group results.

Results

In comparison to the control group, cognitive function was significantly improved and distress was reduced in the intervention group.

Conclusion

Repeated memory tasks combined with rhythmic music were effective both in improving memory capacity and reducing stress.

Keywords

Rhythm Music; Repeat Phrase; N-Back Task; Dual-Task; Distress

Introduction

According to the Japanese Ministry of Health, Labor and Welfare, the estimated prevalence of dementia is 15% of the over-65 population. The number of people suffering from dementia is estimated to be 4.62 million people of the elderly population of 30.74 million (2012 Statistics) [1]. Alzheimer-type dementia (AD) accounts for over 60% of cases of dementia, the highest of all types [2]. The number of dementia incidence continue to

***Corresponding author:** Kazue Sawami, Nara Medical University, Japan. E-mail: sawami@naramed-u.ac.jp

Received October 05, 2017; **Accepted** October 23, 2017; **Published** November 5, 2017

Citation: Kazue Sawami (2017) Verification of the Impact of Storage by the Rhythm Phrase to be Repeated. SF J Geriatrics Pallia Care 1:1.

increase every year [3] and incidence rates double every 5 years in elderly people over the age of 65 [4]. The task of developing countermeasures is urgent. However, the amyloid vaccine developed in 2000 could not suppress the decline in cognitive function even after the removal of amyloid-β from the brain [5]. Therefore, although preventative measures before the onset of dementia is most important in the present situation, implementation of these measures regionally is still at the exploring stages and effective implementation is being sought.

Participants from City Kashihara's elderly population were recruited publicly and invited to participate in an intervention study of 3 months. Comparisons of the control group and intervention group were conducted before and after, and the effects of the experiment were verified.

In previous studies conducted on brain training, the effectiveness of the n-back task (a delayed recall task for items shown n steps earlier) was verified. Meta-analysis results showed activity in the frontal lobe and parietal cortex area [6, 7]. The brain has been reported to be more active during dual-task (performing two tasks simultaneously) than single-task (one-task activities such as exercise only, learning only) and activity in the anterior cortex has been verified [8, 9]. Based on these previous studies, synergistic effect was expected in combining n-back task and dual-task in this study experiment.

Furthermore, lyrics are remembered easily in daily life and can be recalled and sung even if months or years have passed. Many people surely know phrases with music are easy to remember, but difficult to forget. The condition for a musical phrase to be retained in memory like an earworm is said to be not too simple but not too complicated. In addition, the music must be simple, have a rhythmical pattern and a tempo fast and light enough for the body to move to it [10-12]. A rhythmic phrase with music can be expected to potentially have a promoting effect on memory. Rhythmical movement is known to activate serotonin [13, 14].

Serotonin is said to stabilize the mind and body, and influence memory and learning functions in the hippocampus in the brain. The aim is to improve memory abilities by developing upon previous studies through intervention experiments. In the pre-tests conducted, a negative correlation between stress and cognitive function was discovered. Higher scores on the memory test while participants were in a stress-free state [15]. Therefore, the second aim is to reduce stress through the intervention study.

The purpose of this study is to verify a new training method combining rhythmic music and repeated memory tasks, and aims to reduce stress and improve memory at the same time. An intervention study was conducted over 3 months, and compared results from the intervention group and the control group.

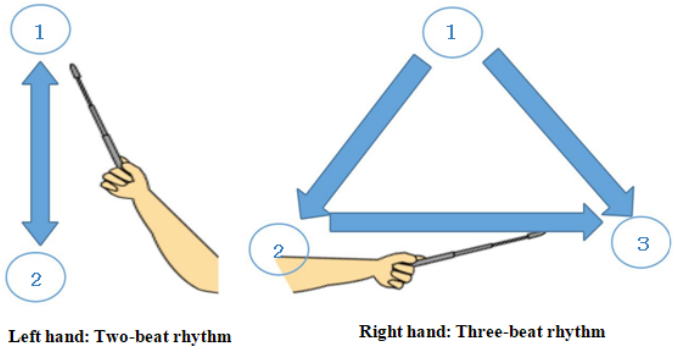
Methods

Target group: Participants from the elderly population of City Kashihara Period: April – September 2016 Intervention: Once a month, over 3 months Intervention method developed:

1. Select simple and rhythmic patterns and music with repetitions

2. Implement dual-task with rhythm. Dual-task is a task to perform two tasks simultaneously where the right hand performs the task on a two-beat rhythm, and the left hand on a three-beat rhythm (see Figure 1). Registered with the Japan Cognicise Executive Office who promotes dual-task exercise methods.

Figure 1: Two –beat rhythm and three-beat rhyhm



3. Implement n-back task before, during and after music is played. n-back task is a delayed recall task which increases the difficulty as items are recalled n steps back. For example: 1-back task: answering what the previous task was. 2-back task: answering what the task 2 tasks ago was. 3-back task: answering what the task 3 tasks ago was.

Evaluation method

Evaluated with the following screening tests and measuring instruments

1. Screening test for mild cognitive impairment (MCI): Montreal Cognitive Assessment (MoCA test) was

conducted 3 times. Before intervention, after the control period and after the intervention. Full marks being 30 The higher the score, the higher cognitive function. Cut-off value score is 26 points. Permissions to conduct the test from Dr. Ziad Nasreddine, the developer of the test, and Dr. Hiroyuki Suzuki of Tokyo Metropolitan Institute of Gerontology, the translator of the Japanese version of the test, were obtained.

2. α-amylase levels of saliva taken from the sublingual gland were measured to measure eustress and distress. As shown in Figure 2, sympathetic nerve activity is reflected. Unpleasant stimulation causes levels to rise and pleasant stimulation causes it to decrease. Eustress and distress were measured in 30 seconds using saliva. The standard values of α-amylase levels in saliva from the sublingual gland according to Nipro, the manufacturer of the α-amylase test kit, are as shown in Table 1.

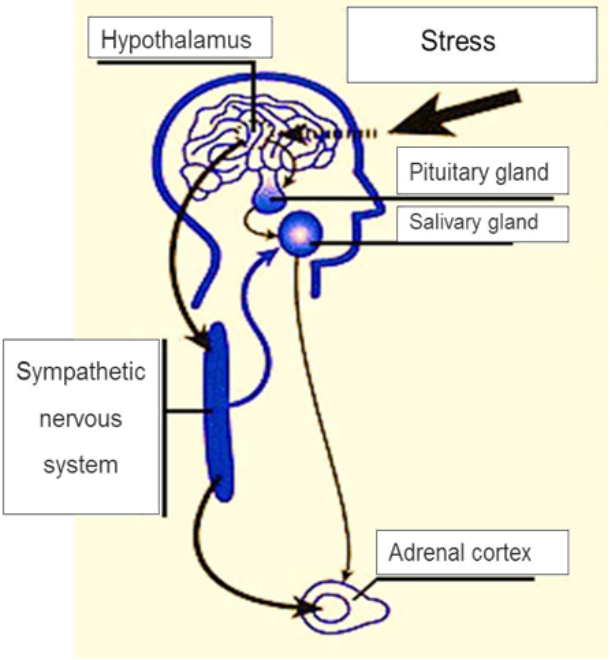


Figure 2: Mechanism of amylase secretion into saliva

Table 1: The reference values of salivary α- amylase

	0-30 KU/L	There is no negative stress.
	31-45 KU/L	There is slight negative stress.
	46-60 KU/L	There is negative stress.
	61 KU/Lor more	There is a high amount of negative stress.

Analysis Method

To compare the scores of MoCA test and the concentrations of α-amylase in sublingual saliva before and after the intervention, the corresponding t-test was carried out. Pearson correlation coefficient was used for the relationship among each of test items.

Ethical consideration

This study was approved by Research Ethics Committee of Nara Medical University before the implementation (approval number: 741).

Subjects were explained verbally and in a written form about study purposes and methods, free-will participation and the right to refuse, privacy protection, data management methods, and release of the results. They participated in this study by signing in the letter of consent.

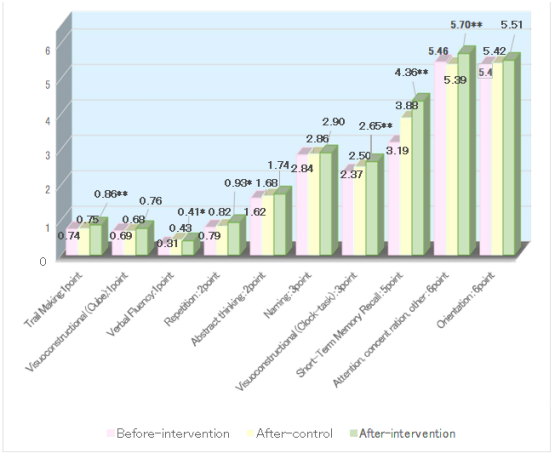
Clinical Trial Registration

This study has been registered in the clinical trial registration database: University Hospital Medical Information Network (UMIN); registration number: R000028956. (https://upload.umin.ac.jp/cgi- open-bin/ctr/ctr_view.cgi?recptno=R000028956).

Result

Among the 108 participants, data of the 79 that participated until the end were analyzed. The average age of the subjects is 75 ± 8.2, with 12 being male and 67 being female. For the cognitive function, the average value of score for each category on the MoCA test and the t-test results are indicated in Figure 3

Figure 3: Comparison before and after the intervention and control of the mean value of MoCAtest



Corresponding paired t-test, n = 79.
**Significant at 1% level, *Significant at 5% level

The average total score in the MoCA test before the intervention was 23.4 points (< 26 points), and it did not meet the cut-off value. After the non-intervention control period of 3 month, when measured again, it was 24.7 points (< 26 points), though with a slight increase in the total score, there was not much changed in each cognitive category. After the intervention, the average total score was 25.8 points (< 26 points), it increased to a score significantly closer to the cut-off value. Figure 4

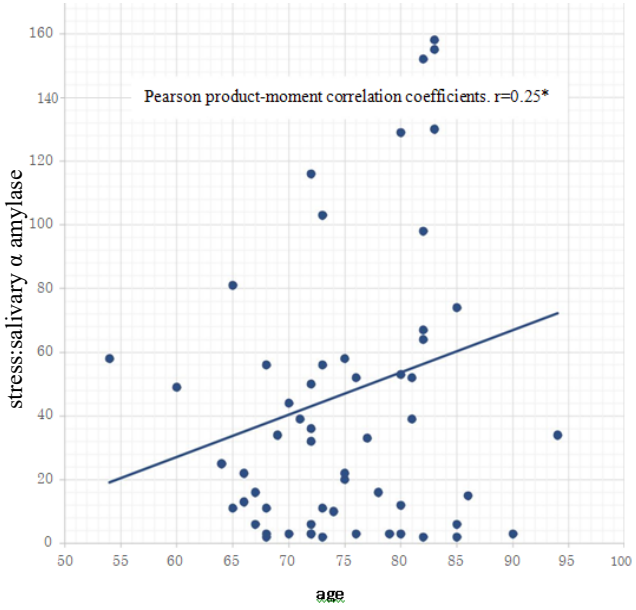


Figure 4: Correlation between stress (α-amylase) and age

***Significant at 5% level**

For each cognitive item, a significant function improvement was acknowledged in trail making and clock drawing (visual-spatial cognitive ability), verbal fluency (exploration of semantic memory), repetition immediate memory, short-term memory, recall delayed-memory, recall repeat, reciprocal number, target detection, subtraction task concentration, attention, memory ($p < 0.05$).

Next, for α-amylase of the stress measurement results, as indicated in figure 4, there is a correlation with the age. In it indicates that the older the person was the stress level was greater (Pearson product-moment correlation r=0.25) Table 2.

Subsequently as for the results of measuring stress (α-amylase), the control group did not show any significant change, while the intervention group showed a significant decrease in negative stress from 47.88 (before the intervention) to 40.51 (after the intervention) on average ($p < 0.01$). Figure 5

Table 2. Before and after comparison of sublingual salivary α- amylase: Paired T-test

Before intervention	After control	After intervention
47.88	48.60	40.51 **

**Significant at 1% level

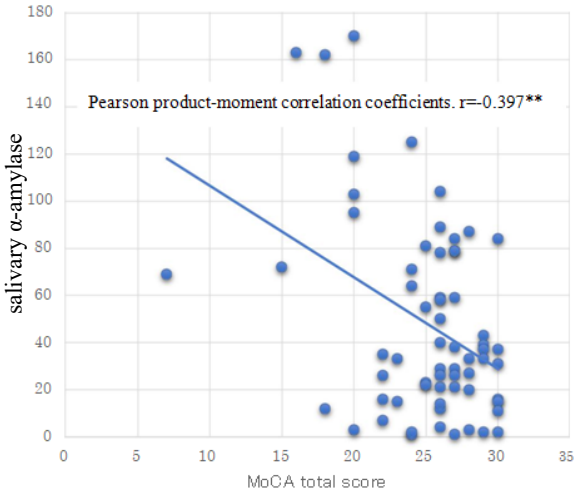


Figure 5. Correlation between cognitive function (MoCA test) and stress (α-amylase)

In addition, there was a negative correlation between the result of MoCA test and salivary α-amylase, and subjects with higher cognitive functions had lower negative stress as shown in Figure 5 (Pearson correlation coefficient, $r = -0.397$).

Discussion

The implementation of preventive intervention of AD in each municipal is still under development and the trial-and-error stages. Therefore, in the present situation, establishing effective techniques and accumulating verifications of intervention study results is an urgent task at hand. What is noteworthy in this study is it verified that repetition of rhythmic phrases in combination with music promotes memory retention. The conditions for rhythmic phrases to be retained in the memory like an earworm have been mentioned above [10-12]. An earworm is a phenomenon where rhythmic phrases are automatically recalled repeatedly. This condition was utilized in conjunction with brain training. It was predicted that the

effect of brain training will be enhanced through the use of the memory promoting effects of rhythmic phrases with music.

The results of the MoCA test showed this method was effective as the intervention group scores improved significantly compared to the control group. The method used was combining brain training activities: dual- task and n-back task; and rhythmic phrases and music. The effectiveness of dual-task and n-back task hadnnalready been verified in previous studies [16-18]. In particular, since it has been verified to activate the prefrontal cortex, which tends to deteriorate with age, these brain training tasks are suitable for the elderly [19, 20].

Although continuous brain training was accompanied by stress in some cases, distress was significantly reduced instead, using the method in this study. It can be inferred that music influenced recovery from fatigue [21, 22]. From the findings of this study, a negative correlation between cognitive function and stress was discovered ($p<0.01$). Therefore, it can be seen to maintain improvement of cognitive functions, it is imperative to reduce stress. Stress increased significantly as age increased ($p<0.05$). From this result, it can be seen that physical and mental disorders increase with age. A recent survey by the Ministry of Health, Labor and Welfare revealed that physical and mental disorders accompanying age, and the unease accompanying the disorders [23]. As the aged society is an issue, the significance of stress prevention is also extremely large. The fact the method developed in this study promoted stress prevention and brain training is a noteworthy benefit.

The method developed in this study utilized “ostinato”, a rendition often used in music such as jazz. This method repeats a short phrase multiple times. As it has a trait which makes it easy retain and recall, it is easy to recall during memory and recall tasks when incorporated into these activities. A repeated melody which speeds up steadily is easily retained in memory.

Music can also help recollecting memories[24-26] and through this, recalling memory and emotional activity can both be anticipated [27-29]. The hippocampus is activated when the participant recalls emotionally stimulating images. In comparison to recalling an emotionally neutral image, one which is more emotionally strong links to stronger activity in the hippocampus. A synergistic effect can be expected when the hippocampus is stimulated through recollection through music as well.

For the above reasons, brain training tasks combined with repeated rhythmic phrases and music effective for memory tasks. It can be expected for emotion to be influenced by music leading to activity in the hippocampus.

Conclusion

This study combined repeated rhythmic phrases and music with brain training memory tasks. This music method proposed a new brain training method by combining dual-task, where two tasks are performed simultaneously, and n-back task, where tasks from n tasks earlier are asked to be recalled.

This intervention study verified this method improved memory test results significantly and a reduction in stress value.

Acknowledgments

We thank the elderly who continue to participate in this study. In this study, under the guidance of music therapists Yukiko Ueda and Megumi Okuno, we developed a rhythm phrase combining a dual task and n-back task. Thanks to both lecturers, the intervention method has evolved into a more effective program. We sincerely thank everyone for their support.

References

1. Ministry of Health, Labour and Welfare (2014) Current situation of measures and policies against dementia. Document of 115th Sectional Meeting of Nursing Care Payment 1-21.

2. Shimohama S (2015) Early Detection and Prevention of Dementia. J Intern Med 20: 76-80.

3. Ministry of Health, Labour and Welfare (2010) Situation of hospitalized patients suffering from dementia in mental hospitals. Document of 13th Meeting of the Consideration Team toward Development of New Local Mental Health Care System: 1-63.

4. Qiu C, Kivipelto M, Chengxuan Qiu (2009) Epidemiology of Alzheimer’s disease: occurrence, determinants, and strategies toward intervention. Dialogues Clin Neurosci 11: 111-128.

5.Holmes C, Boche D, Bayer A (2008) Long-term effects of Abeta42 immunisation in Alzheimer’s disease: follow-up of a randomised, placebo-controlled phase I trial. Lancet 372: 216-223.

6. Erickson, K, Voss M, Chandramallika B (2011) Exercise training increases size of hippocampus and improves memory Proc Natl Acad Sci108: 3017-3022.

7. Owen AM, McMillan KM, Daniel RJ (2005) N-back working memory paradigm: A meta-analysis of normative functional neuroimaging studies. Hum Brain Mapp 25: 46-59.

8. Al-Yahya E, Johansen-Berg H, **Udo** K (2015) Prefrontal Cortex Activation While Walking Under Dual-Task Conditions in Stroke: A Multimodal Imaging Study. Neurorehabilitation and Neural Repair 30: 9.

9. Ohsugi H, Ohgi S, **Shigemori** K (2013) Differences in dual-task performance and prefrontal cortex activation between younger and older adults. BMC Neuroscience 14: 1-9.

10. Kellaris J, Robert B, Taylor (2001) Identifying Properties of Tunes That Get 'Stuck in Your Head. Proceedings of the Society for Consumer Psychology. Am Phys Soc 66-67.

11. Williamson JV, Jilka RS, Williams TI (2012) How do "earworms" start? Classifying the everyday circumstances of Involuntary Musical Imagery. Psychology of Music 40: 259-284.

12. Andrews-Hanna JR, Reidler JS, Huang C (2010) Evidence for the default network's role in spontaneous cognition. Journal of Neurophysiology 104: 322-335.

13. Ohmatsu S, Nakano H, Suishu C (2014) Activation of the serotonergic system by pedaling exercise changes anterior cingulate cortex activity and improves negative emotion. Behav Brain Res 270: 112-117.

14. Fumoto M, Oshima T, **Kamiya** K (2010) Ventral prefrontal cortex and serotonergic system activation during pedaling exercise induces negative mood improvement and increased alpha band in EEG. Behav Brain Res 213: 1-9.

15. Sawami K, Mitsuo K, Bavojdan MR (2017) Relationship between Mental Health Stress Levels and Cognitive Function. Journal of Addiction Research 1: 1-6.

16. Holtzer R, Mahoney JR, Mirelman A (2011) fNIRS study of walking and walking while talking in young and old individuals. J Neuroeng Rehabil 66: 879-887.

17. Susanne JM, Studer-Luethi B, Beurskens R (2010) The relationship between n-back performance and matrix reasoning implications for training and transfer. Intelligence 38: 625-635.

18. Sawami K, Nakagawa H, Sheehan B (2017) Relationship between cognitive function, vascular age and stress. Int J clinical and case 1: 83-89.

19. Otsuka Y, Osaka N, Schwartz BL (2005) Working memory in the elderly: Role of prefrontal cortex. Japanese Psychological Review 48: 518-529.

20. Yogev-Seligmann G, Hausdorff JM, Giladi N (2008) The role of executive function and attention in gait. Mov Disord 23: 329-342.

21. Sawamura K (2004) A Psychophysiological Study of Thermograpry with a Stimulative Music. Clinical Educational Psychology Research 30: 65-70.

22. Kotake N, Nakamura K, et al. (2004) J Music Ther. Siebold University of Nagasaki 5: 1-10.

23. Ministry of Health (2015) Labour and Welfare.Condition and consciousness about health. Welfare labor white paper 43-131.

24. Katagiri M (2012) Study on the Recall of Long-term Memory by Music Therapy in Elderly People with Cognitive Impairment. Bulletin of TokyoUniversity and Graduate School of Social Welfare 191-196.

25. Suzuki T (2014) Analysis of the "familiar music" for the elderly. Bulletin of Fukui Prefectural University 45-59.

26. Sakashita M (2008) Positive effect of "familiar music" on demented elderly: intervention taking account of narrative. Ritsumeikan educational science research 16: 69-79.

27. Umemoto M (2015) The effect of reminiscence with stimulation of sound in elderly living in the community.The Journal of Japan Society for Early Stage of Dementia 8: 48-55.

28. Sakashita M (2006) A study on reminiscence effects to dementia elderly: a narrative approach in musictherapy. Japanese bulletin of art therapy 37: 89-95.

29. Dolcos F, LaBar SK, Cabeza R (2005) Remembering one year later: role of the amygdala and the medial temporal lobe memory system in retrieving emotional memories. Proc Natl Acad Sci U.S.A. 102: 2626-2631.

Citation: Kazue Sawami (2017) Verification of the Impact of Storage by the Rhythm Phrase to be Repeated. SF J Geriatrics Pallia Care 1:1.