

Effects of Brain Stimulation in Group Activities on the Cognitive Function Improvement of the Elderly People in the Community Health Center of Bojonagara Area in Bandung Municipality

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How to cite this paper: Meilianingsih, L. and Husni, A. (2019) Effects of Brain Stimulation in Group Activities on the Cognitive Function Improvement of the Elderly People in the Community Health Center of Bojonagara Area in Bandung Municipality. *Open Journal of Nursing*, 9, 891-900. <https://doi.org/10.4236/ojn.2019.98066>

Received: July 9, 2019

Accepted: August 20, 2019

Published: August 23, 2019

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Abstract

The success of development in the health sector has an impact on improving the health status and life expectancy of the people of Indonesia. Increasing life expectancy leads to an increase in the number of elderly people in Indonesia. Increasing the number of elderly population, on the one hand, is encouraging but on the other hand, it creates complex problems. Problems that are often faced by the elderly over time occur due to a process of decline that has an impact on changes in the structure and function of organs including the brain. These conditions have an impact on decreasing brain cell function which results in impaired cognitive function in the elderly. The aging affecting cognitive impairment will cause the elderly to have impairment in carrying out daily activities so that they will depend on others and eventually, their quality of life decreases. One of the efforts to resolve such issue is by maintaining and improving cognitive ability through brain stimulation. Optimum brain stimulation is combining physical, mental, social and spiritual stimulation into one activity. This research aims at finding out the “Effects of Brain Stimulation in Group Activities on the Cognitive Function Improvement of the Elderly People in the Community Health Center of Bojonagara Area in Bandung Municipality”. Quasi-experimental design is used in this research with Pre Post test control group design approach. Samples used are 36 people for intervention group and 36 people for control group. The sample is taken using purposive sampling technique. The intervention of brain stimulation is provided 3 times a week for 7 weeks. Brain stimulation is provided through brain gym, relaxation and dhikr. Data are analyzed using Wilcoxon and Mann Whitney. The research result indicates the effects of brain stimulation in group activity on cognitive function of the elderly people (p value 0.001).

Therefore, it is suggested that the head of the community health center and the lead of elderly health programs apply brain stimulation as structured activity for elderly intelligent health in the working area of the Community Health Center.

Keywords

Brain Stimulation, Group Activity, Elderly

1. Introduction

Indonesia is the third Asian country with the largest population of elderly people. In 2010, the total elderly people in West Java were 2,880,548 lives [1]. In 2005, there were 500,000 people suffering from dementia in Indonesia and in 2007, there were 2500 people suffering from dementia in West Java [2]. The aging affecting cognitive impairment will cause the elderly to have impairment in carrying out daily activities so that they will depend on others and eventually, their quality of life decreases. On the one hand, the increasing number of elderly populations is encouraging, however, on the other hand, it creates complex issues. The complexity of issues faced by the elderly people is a challenge to improve their health and welfare in accordance with the health development goals. As time goes by, issues often faced by the elderly are caused by the process of decline that has an impact on changes in the structure and function of organs including the brain [3]. Changes in brain and nerve cells can interfere with the memory of the elderly. During the degenerative process of the brain, there will be changes in cognitive function, namely difficulties in recalling, reduced ability to make decisions and slower actions.

The aging process which affects cognitive impairment will cause the elderly to experience disruption in carrying out daily activities so that they become dependent and they need to be assisted by others to carry out all activities and eventually, the quality of life of the elderly decreases. Unfortunately, aging cannot be stopped. It is a natural process that occurs in all humans. Aging cannot be stopped but can be slowed down. One of the efforts to resolve such issue is by maintaining and improving cognitive ability through brain stimulation [3]. Therefore, it is necessary to make efforts to maintain and improve cognitive abilities by increasing brain stimulation. Optimum brain stimulation is combining physical, mental, social and spiritual stimulation into one activity [4] [5] [6] [7]. Changes in brain and nerve cells can interfere with the memory of the elderly [8] [9]. During the degenerative process of the brain, there will be changes in cognitive function, namely difficulties in recalling, reduced ability to make decisions and slower actions [10].

In order to identify the cognitive function in the elderly, Mini-Mental State Examination (MMSE) questionnaire can be used [3] [11] [12].

Optimal brain stimulation is carried out by combining physical, mental, social and spiritual stimulation into one activity [4] [5] [6] [7]. Brain stimulation can be applied to the elderly in groups in the community. Brain stimulation activities for the elderly in groups can help the process of involvement of the elderly in activities aiming at improving the cognitive and social functions. In addition, there will be more interaction between the elderly and the surrounding environment so that it can improve psychosocial health. Brain stimulation will affect the cognitive function if it is carried out in structured within seven weeks or more and carried out for 45 minutes, twice a week [7] [11].

2. Methods

2.1. Study Design

Brain stimulation in group activities can improve cognitive function of the elderly in the Community Health Center of Bojonegara Area in Bandung Municipality.

2.2. Population and Sample

This research used Quasi-Experimental design, pretest-posttest control group design. The number of samples is taken by using a large sample formula for hypothesis testing difference 2 on average with a standard deviation (σ) of 3.5, the average before treatment in the previous study 17.11 (μ_1), and the average after treatment at Previous research was 20.05 (μ_2) [13] so that the sample size for this study was 33 people, plus the anticipation of a dropout 10% was as many as 3 people so that the Total samples are 36 people, for each group both in the intervention and control samples. The sampling technique in this research is purposive non-random sampling, with the inclusion criteria as follows:

- 1) Elderly with the age of 50 - 69 years old
- 2) Elderly with normal-light impairment of cognitive function
- 3) No abnormality based on the result of screening with ABCD on the following:
 - Daily living activities using KATZ Index is included as A category
 - Balance, using Berg test, score 41 - 56
 - Cognitive, using test MMSE, score ≥ 19
 - Disease: Not suffering hypertension, Diabetes Mellitus and not having the history of stroke or brain disorder
- 4) Elderly residing in the Area of Bojonegara Community Health Center (Garuda Community Health Center, Sukajadi Community Health Center and Pasirkaliki Community Health Center)
- 5) Elderly must carry out all intervention activities in the research
- 6) Able to communicate well and read as well as write

Of the 126 elderly who live in the Bojonegara Health Center area (Garuda Health Center, Sukajadi Health Center, and Pasirkaliki Health Center) we took 36 elderly who passed the screening for the intervention group and 36 elderly for

the control group.

Univariate analysis is carried out to find out the cognitive function of the elderly before and after the intervention. Bivariate analysis is carried out using Wilcoxon signed-rank to see the difference of each proportion and Mann Whitney U to compare the difference between the intervention and control groups.

2.3. Research Procedure

Preliminary cognitive data collection was carried out using the MMSE instrument. It was carried out in the intervention group and control group. The data were collected approximately in 15 - 20 minutes. In the intervention group, brain stimulation intervention was carried out with researchers, students and cadres as facilitators. Brain stimulation was carried out for 7 weeks and 3 times a week (it was carried out two times with facilitators and one time independently) in order to carry out brain stimulation activities including brain gym (physical activity) for 30 minutes, breathing relaxation and dhikr (mental and spiritual activities) for 15 minutes. To ensure the participation of respondents in these activities is used the participation observation form in each activity. Subsequently, final measurement of cognitive function was carried out to the intervention and control groups.

3. Results

Before looking at the results of the study, we need to know the demographic data from the research respondents, as follows **Table 1**:

Table 1. Frequency distribution of respondents based on gender, age, and education.

Characteristics	Intervention Group		Control Group	
	Total	%	Total	%
Gender				
Male	1	2.8	2	5.6
Female	3.5	97.2	34	94.4
Age				
Pre-Elderly (50 - 59 yr)	18	50	16	44.4
Elderly (60 - 69 yr)	18	50	20	55.6
Education				
Not Educated	1	2.8	2	5.6
Elementary School	14	38.9	14	38.9
JHS	9	25.6	9	25.6
SHS	11	30.6	9	25.6
College	1	2.8	2	5.6

The cognitive abilities of the elderly before and after brain stimulation are likely to be different because brain stimulation is a factor that can affect the cognitive abilities of the elderly. For more details can be seen in the following:

Table 2 indicates comparison of cognitive Function before and after brain Stimulation in group activities. In the intervention group, there is an increase in the average cognitive function score, namely from 25.56 to 29.06 and the result of Wilcoxon test indicates p value $0.00 < \alpha (0.05)$. Null hypothesis is rejected which means there is an effect of brain stimulation in group activities to the cognitive function of the elderly. Meanwhile, in the control group to which the brain stimulation intervention is not carried out, there is average decrease, namely from 26.36 to 26.11 and p value $0.066 > \alpha (0.05)$ is obtained which means null hypothesis is accepted and there is no difference in cognitive function in the initial and final measurement.

Based on **Table 3**, cognitive function in the intervention group following brain stimulation in group activities indicates the lowest score of 22 (mild cognitive function impairment), the highest score is 30 and the average score increased from 25.56 to 29.06 (good cognitive function). It indicates increase in the cognitive function score.

The cognitive function of the control group in the initial and final measurement is constant, namely: the lowest score is 19, the highest score is 30 and the average score is 26.11. It indicates decrease in the cognitive function score.

We can see in the table above the difference in the data on initial measurement result prior to the brain stimulation on the treatment group and the cognitive function of the initial measurement in the control group indicates p value $0.317 > \alpha (0.05)$ with null hypothesis is accepted which means there are not any differences in cognitive function of initial measurement both in the intervention group and control group.

Table 2. Pre- and post-brain stimulation cognitive function of the intervention group and the control group in group activities.

Cognitive Function	Pre-Treatment	Post-Treatment	P value
Intervention Group	25.56	29.06	0.000
Control Group	26.36	26.11	0.066

Table 3. Difference in cognitive function between the intervention group and the control group prior to initial treatment/measurement and after final treatment/measurement.

Cognitive Function	Intervention Group			Control Group			P value
	Mean	Min	Max	Mean	Min	Max	
Prior to Initial Treatment/Measurement	25.56	19	30	26.36	19	30	0.317
After Final Treatment/Measurement	29.06	22	30	26.11	19	30	0.001
Change	3.5	3	-	0.25	-	-	

The table above indicates comparison of cognitive function in the final measurement/following brain stimulation both in the intervention group and the control group. Based on Mann Whitney test result, p value is $0.001 < \alpha (0.05)$ and null hypothesis is rejected which mean there is a difference in the cognitive function of the intervention group and the control group.

4. Discussion

The result of Wilcoxon test from pre- and post-brain stimulation on the intervention group indicates p value $0.00 < \alpha (0.05)$, null hypothesis is rejected which means there is an effect of brain stimulation in group activities on cognitive function. This research is also in line with the research conducted by Widayani which explains that there is an effect of brain stimulation on the improvement of cognitive function (p value 0.00) [14]. A similar research was also conducted by Kusharyadi with the result of p value 0.001 [15]. Brain stimulation is the provision of stimulus in the form of information to develop the ability to process information management performance in the brain. Brain stimulation can also be interpreted as the provision of stimulus to improve the quality of intelligence possessed and provided structurally [4] [5] [11] [16]. Brain stimulation can have a positive effect on mood, improve memory and produce maximum cognitive development of brain so as to improve the quality of life [4] [16]. According to Hall CB, the more brain stimulation activity carried out may reduce the risk of memory loss by 30% - 50% [5].

The result of analysis of the initial and final measurement in the control group indicates p value $0.066 > \alpha (0.05)$. Null hypothesis is accepted which means there is no effect of brain stimulation in the group activity on the cognitive function. This research is also in line with the result of research by Kusharyadi in the control group which was not treated in which p value 0.642 was obtained. It happened because no intervention was carried out.

Based on the result of interview with the person in charge of elderly health and each head of integrated coaching post (*posbindu*) cadre in the Community Health Center of Bojonegara Area in Bandung Municipality, data were obtained which indicated that elderly people in the control group only followed regular activities in the integrated coaching post for elderly, namely regular medical check-up including measurement of Body Weight, Body Height, Blood Pressure. Meanwhile, intelligence health program for the elderly including brain stimulation activity had not been carried out. Cognitive function of the elderly will decrease if no action is taken or brain stimulation is not carried out [17].

In the measurement prior to the treatment/initial treatment there was no difference in cognitive function of the intervention group and the control group with p value $0.317 > \alpha (0.05)$. This illustrates that both groups had the same beginning in the research. However, the measurement following treatment/final analysis result indicated significant differences in the cognitive function of the intervention group and the control group (p value 0.001). Such result can be in-

terpreted that the brain stimulation is significant or has effect on the cognitive function of the elderly.

In the intervention group, prior to the brain stimulation treatment, mean or average score of the cognitive function was 25.56 of the maximum score of 30. This condition indicates that the cognitive function prior to the intervention has been good but not optimal. Meanwhile the minimum score was 19. However, after treatment was provided to the intervention group in the form of brain stimulation in group activities, there was a change in the Mean score to be 29.06 and the minimum score became 22. It indicates increase in the cognitive function. The change or increase in scores obtained following the treatment was 3.5.

Brain stimulation carried out is brain gym, relaxation, dhikr and involvement of the elderly in group activities. Optimal brain stimulation is carried out by combing physical mental, social and spiritual stimulation into one activity [4] [5] [6] [7]. Brain stimulation activities for the elderly carried out in group may help the involvement process of the elderly in activities aiming at improving cognitive function [5].

In this research, brain stimulation was provided structurally for seven weeks. Brain stimulation will affect the cognitive function if it is carried out structurally within seven weeks or more and it is carried out for 45 minutes, three times a week [7] [11]. Based on several corresponding researches, brain vitality gym can improve cognitive function with p value 0.05 [18]. Similar research was also carried out by Eko Susilo with the result of p value 0.000 [13]. Movement in the brain vitality gym can provide stimulus which can improve the cognitive ability (alertness, concentration, speed, perception, learning, memory, problem solving and creativity). In addition, the brain vitality gym improves balance and harmonization between emotional-logic control, optimizes performance function of five senses, maintains flexibility and improves memory [19]. Regular exercise can increase protein in the brain called Brain Derived Neurotrophic Factor (BDNF) [5]. BDNF protein plays an important role in keeping nerve cells fit and healthy. There have been many researches concerning the role of BDNF in memory function. The low level of BDNF may lead to dementia. Physical exercise reduces dementia by 35% [20].

In this research, brain stimulation was also provided through mental activity, namely relaxation. Mental stimulation can improve or maintain the cognitive function of the elderly. Mental stimulation carried out continuously can improve the relationship between brain cells, so that there is a reserve of cognitive function for the elderly which can inhibit the decline in cognitive function. Several researches have shown that mental activities can reduce stress and improve cognitive function. Severe and chronic stress can shrink the hippocampus which causes Alzheimer [6]. Relaxation is one of mental activities which can increase calmness, reduce stress and anxiety [21]. One of the types of relaxation is breathing relaxation. Deep and gentle breathing causes blood circulation to be filled with oxygen, cleanse metabolism and clearer thinking process [21]. The

result of research by Kadek Oka Aryana indicates that relaxation has an effect on reducing stress with p value 0.002 [22].

Spiritual activity in the form of dhikr is also the treatment provided in this research. Spiritual activity can give the meaning of life, self-worth and life expectancy for the elderly, so as to stimulate their cognitive function. Research on 3050 elderly people carried out by Hill indicated that those who attend religious events regularly tend to experience cognitive decline slower than those who do not actively involve in religious activities [23]. Solemn prayer, dhikr can train the elderly to concentrate/focus their attention on new things. Dhikr is one of the efforts to get closer to Allah by remembering Him. Dhikr process by pronouncing tawhid and *istighfar* sentence will increase the disposal of CO₂ in lungs and lead to mental tranquility and relaxation [24]. The result of research conducted by Widuri and Subandi indicates that dhikr therapy had significant effect on reducing stress level (p value 0.004) [25].

In this research, brain stimulation was provided in group activity. Active participation in social activities and interaction with other people can help to stimulate the cognitive function and slowing down the occurrence of dementia [4] [5]. Maintenance and coaching of various social relations, as well as active participation in social activities can prevent cognitive decrease in the elderly. Result of research carried out by Riyanto indicated that the elderly participating in social activities such as Quran recitation, or meetings in the community less than one time a week had risk 1788 times greater to have poor cognitive function compared to those having social activities more than or equal to one time a week [26].

5. Conclusions

There was an effect of brain stimulation in group activities on cognitive function of the intervention group with p value 0.000. Meanwhile, in the control group there was no difference in the initial and final measurement with p value 0.066.

In the measurement prior to the initial treatment/measurement, there was no difference in cognitive function in the intervention group and the control group with p value 0.317. However, in the measurement following the final treatment/measurement, there were significant differences in cognitive function of the intervention group and control group (p value 0.001). The average score of cognitive function of the elderly prior to the treatment in the intervention group was 25.56 and following the treatment, there was an increase of 3.5, and the average score became 29.06. Meanwhile, the cognitive function of the initial measurement in the control group had an average score of 26.36 and in the final measurement, there was a decrease in the average score to be 26.11.

The result of this research shows that brain stimulation can improve the cognitive function of the elderly. Therefore, the person in charge of elderly health programs and implementing nurses in the community health center can apply brain stimulation in the structured activities of elderly intelligence health in the

Community Health Center in order to maintain and improve cognitive ability of the elderly group in the community.

Ethical Clearance

The research has been approved by the ethics commission of health research in Bandung health Polytechnic with a number 19/KEPK/PE/V/2018. To maintain the principle of justice for the control group, then after the study was completed information was provided through the same guidebook and brain stimulation.

Gratitude Expression

Thank you to the PIC of the elderly health program and the posbindu coordinator at the Pasirkaliki Health Center, Garuda Health Center, and Sukajadi Health Center, who have provided support and assistance during the research.

Source of Funds

This research fund comes from the budget of the Bandung Health Polytechnic with numbers SP DIPA-024-12.2, 632221/2016 fiscal year 2017.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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Appendix

MMSE: Mini-Mental State Examination

BDNF: Brain Derived Neurotrophic Factor

Posbindu. Pos Pembinaan Terpadu

ABCD: Activity, Balance, Cognitive, Disease