

## THE EFFECTS OF READING ACTIVITY ON EPISODIC MEMORY IN ELDERLY

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**Abstract:** *The aging process is a natural event that cannot be avoided. Especially in the elderly, this is accompanied by a decrease in episodic memory function, which can reduce the quality of life. Therefore, efforts are needed to maintain cognitive function in elderly, one of which is through routine cognitive activities such as reading which can affect memory function in elderly through neuroplasticity. This study aims to determine the effect of reading activity on episodic memory function in the elderly. This research is a quasi-experimental study with a pre-test post-test control group design method. The total research subject were 30 people in Desa Demangan Siman, Kabupaten Ponorogo and Kelurahan Ngadirejo, Kota Kediri, with a sample technique using random purposive sampling. The research subjects were then divided into 3 groups with random allocation techniques using microsoft excel. Group 1 was the control group, group 2 was the 15-minute reading aloud intervention group, and group 3 was the 30-minute reading aloud intervention group. The results of the Dependent T-test showed that there was a significant difference in mean scores between the pre-test and post-test scores in group 2 ( $p = 0.000$ ) and group 3 ( $p = 0.000$ ), but not significant in group 1 ( $p = 0.111$ ). The One Way ANOVA test results showed a significant difference in post-test scores in the three groups ( $p = 0.043$ ), and the Post-hoc LSD test found a significant difference in scores between the post-test scores in group 1 with group 2 ( $p = 0.025$ ) and group 1 with group 3 ( $p = 0.034$ ), but there was no significant difference between the post-test scores in group 2 with group 3 ( $p = 0.883$ ). It can be concluded, there is a significant effect between the duration of reading activity and episodic memory function in the elderly.*

**Keywords:** *aging, elderly, episodic memory, reading, neuroplasticity.*

## **INTRODUCTION**

Aging process is a natural process that could not be averted. This process resulted with the decrease of cognitive function such as episodic memory function, a long-term memory related with experience memory of someone which may contain where, when, and with whom that memory happened, or can be mentioned as autobiographical memory.<sup>1</sup> This is due to a decrease in volume in several areas of the brain and the occurrence of remodeling of nerve cells, thereby affecting their function.<sup>2,3</sup> So that, with a decrease in memory function in the elderly, it can cause a decrease in the quality of life for the elderly. However, the brain has the ability to continue to develop due to repetitive stimuli such as exercise or repetitive activities called neuroplasticity, where the simultaneous stimulation causes neurogenesis to increase brain functions.<sup>4</sup>

Reading is a cognitive activity that requires complex skills, which requires synergy of cognitive functions both verbal and non-verbal such as attention, abstract reasoning, working memory, long-term memory, retrieval of vocabulary and concepts.<sup>5</sup> In the research that has been done, it was found that the elderly who routinely do cognitive activities such as reading a newspaper with a minimum frequency of once a week for a minimum duration of one hour, have a better cognitive function than the elderly who do not routinely do cognitive activities.<sup>6</sup> This is the basis for developing an intervention in the form of cognitive training, one of which is reading aloud in the elderly which can improve episodic memory function.<sup>7,8</sup> So this study aims to determine the effect of reading activity on episodic memory function in the elderly.

## **RESEARCH METHODS**

This research is a quasi-experimental with pre-test pos-test method design. The

research was conducted in Demangan Village, Siman, Ngadirejo, Ponorogo, Kediri. The subjects of this research were 30 of elderly, which divided by 3 research groups (10 research subjects in each group): group 1, which was the control group that was not given intervention; group 2 was the group that was given the intervention in the form of reading books aloud for 15 minutes per day for 14 days; and group 3, which was the group that was given the intervention in the form of reading books aloud for 30 minutes per day for 14 days.

Episodic memory score assessment in this study was using immediate and delayed word list recall test which was carried out at the stage before the intervention and after the intervention was administered by the researcher. Scores before the intervention (pre-test) and after the intervention (post-test) of the three research groups, were in the form of a numeric scale variable, were analyzed using the pairwise two-group difference test using the Dependent T-test and the mean comparative test using the One-Way ANOVA and continued with the Post-hoc LSD test using SPSS 22 for Windows software.

The ethical clearance of this research numbered 116 / UN27.06.6.1 / KEPK / EC / 2020 was issued by the Health Research Ethics Committee of the Faculty of Medicine, University of Sebelas Maret.

## **RESULTS AND DISCUSSION**

Sociodemographic data (Table 1) shows the characteristics of research subjects including age, gender, and educational level; and cognitive function data of research subjects consisting of MMSE (Mini Mental State Examination) scores, episodic memory pre-test scores (immediate and delayed word list recall test), and immediate and delayed word list recall test scores (Table 2).

Table 1. Data of Sociodemographic

| Sociodemographic Data of Patients | Amount | Presentage |
|-----------------------------------|--------|------------|
| Age                               |        |            |
| 60-65 y.o                         | 20     | 66,6 %     |
| 66-70 y.o                         | 5      | 16,6 %     |
| 70-75 y.o                         | 4      | 13,3%      |
| 76-80 y.o                         | 1      | 3,3%       |
| Sex                               |        |            |
| Male                              | 18     | 60%        |
| Female                            | 12     | 40%        |
| Education Background              |        |            |
| Elementary School                 | 10     | 33,33 %    |
| Junior High School                | 3      | 10%        |
| Senior High School                | 4      | 13,33 %    |
| Diploma                           | 3      | 10%        |
| Bachelor                          | 6      | 20%        |
| Post Graduate                     | 4      | 13,33%     |

Table 2. Data of Cognitive Function

| Cognitive Function Data                                       | Amount | Presentage |
|---|--------|------------|
| MMSE Score  |        |            |
| 24  | 2      | 3,33%      |
| 25  | 2      | 6,67%      |
| 26  | 10     | 33,33%     |
| 27  | 7      | 23,33%     |
| 28  | 6      | 20%        |
| 29  | 3      | 10%        |
| 30  | 0      | 0%         |
| Pre-test Score (immediate and delayed word list recall test)  |        |            |
| 0-5   | 6      | 20%        |
| 6-10  | 18     | 40%        |
| 11-15   | 6      | 20%        |
| 16-20   | 0      | 0%         |
| Post-test Score (immediate and delayed word list recall test) |        |            |
| 0-5   | 2      | 6,67%      |
| 6-10  | 9      | 30%        |
| 11-15   | 16     | 53,33%     |
| 16-20   | 3      | 10%        |

The results of the dependent T-test on episodic memory scores using the immediate and delayed word list recall test before and after the intervention in group 1 were the Sig. (2-tailed) or p value > 0.05 (p = 0.111), with a confidence level of 95%. It can be concluded that there was no statistically significant difference between the mean scores of episodic memories before and after the

intervention in group 1. Meanwhile, the Sig. (2-tailed) or p value <0.05 (p = 0.000) in group 2 and also p value <0.05 (p = 0.000) in group 3, so it can be concluded that there is a statistically significant difference between the means episodic memory scores before and after the intervention in group 2 and group 3 (Table 3).

Table 3. Dependent T-test of Episodic Memory Score

| Episodic Memory Score  | Group | p     |
|--|-------|-------|
| Score of immediate and delayed word list recall test before and after intervention | 1     | 0,111 |
|  | 2     | 0,000 |
|  | 3     | 0,000 |

One way ANOVA test on the episodic memory post-test score obtained the Sig. (2-tailed) or p value <0.05 (p = 0.043) with a 95% confidence level, so it can be concluded that there is a statistically significant difference in scores in the three study groups after the intervention (Table 4). Furthermore, in the post-hoc LSD test, it was found that there was a significant difference in the post-test scores of episodic memory between group 1 (control) and group 2 (intervention group),

but there was no significant difference in scores between the two intervention groups, namely group 2 with group 3, namely the Sig. (2-tailed) or p value > 0.05 (p = 0.883). This shows that statistically there is a significant difference in scores between the control group and the intervention group, namely between group 1 and group 2 and also in group 1 and group 3 (Table 5).

Table 4. One Way ANOVA Test of Episodic Memory Score

| Episodic Memory Score   |               |  | Sum of Square | df | Mean Square | F     | p    |
|---|---------------|--|---------------|----|-------------|-------|------|
| Score of Pre-test (immediate and delayed word list recall test) | Between group |  | .867          | 2  | .433        | .060  | .942 |
|   | Within group  |  | 194.100       | 27 | 7.189       |       |      |
|   | Total         |  | 194.967       | 29 |             |       |      |
| Score Post-test (immediate and delayed word list recall test)   | Between group |  | 64.267        | 2  | 32.133      | 3.546 | .043 |
|   | Within group  |  | 244.700       | 27 | 9.063       |       |      |
|   | Total         |  | 308.967       | 29 |             |       |      |

Table 5. Post-hoc LSD Test of Post-test Memory Episodic Score

| Memory Episodic Score                                   | Group | Group | p     |
|---|-------|-------|-------|
| Post-test (immediate and delayed word list recall test) | 1     | 2     | 0,025 |
|   |       | 3     | 0,034 |
|   | 2     | 1     | 0,025 |
|   |       | 3     | 0,883 |
|   | 3     | 1     | 0,034 |
|   |       | 3     | 0,883 |

The provision of intervention in the form of reading aloud regularly is one of the intervention efforts to maintain cognitive function in the elderly, in particular, memory function through the neuroplasticity mechanism. Based on the Dependent T-test, the Sig. (2-tailed) or p value > 0.05 (p = 0.111) in group 1, which can be concluded statistically that there is no significant difference between the mean episodic memory scores in group 1, but there is a statistically significant difference in group 1, group 2 and group 3, with a p value <0.05 (p = 0.000) in group 2 and with a p value <0.05 (p = 0.000) in group 3. This shows that there is a significant difference in episodic memory scores after the intervention in the form of reading books aloud to study group 2 and research group 3, which is in accordance with the neuroplasticity theory, namely that the brain has the ability to continue to develop due to repeated stimuli.<sup>4,9,10</sup> This theory is supported by experimental research that has been done before, which concluded that there was an increase in episodic memory scores after cognitive training, one of which was the provision of intervention in the form of reading aloud.<sup>8</sup>

Based on the One Way ANOVA test, it was found that the difference in the mean score of the post-test episodic memory in the three groups after the study was the Sig. (2-tailed) or p value <0.05 (p = 0.043), this indicates that there is a significant difference in episodic memory scores on reading activity in the three study groups after the

study. After that, followed by the Post-hoc LSD test, it was found that there was a significant difference in the post-test scores of episodic memory between group 1 (Control) and group 2 (Intervention group), namely the Sig. (2-tailed) or p value <0.05 (p = 0.025) and between group 1 and group 3 (intervention group) the value of Sig. (2-tailed) or p value <0.05 (p = 0.034), but there was no significant difference in value between group 2 and group 3, namely the Sig. (2-tailed) p > 0.05 (p = 0.883), this shows that there is a statistically significant difference in values between the control group and the intervention group, namely group 1 and group 2 and also in group 1 and group 3. This is in accordance with the results of observational studies that have been conducted that the elderly who read more often have higher episodic memory scores than the elderly with the habit of reading less frequently.<sup>11</sup> The results of this study are in line with the theory that repetitive stimuli in the brain, one of which is the stimulation of cognitive activity, can cause changes in the volume of the cortex and subcortex to become larger (neuroplasticity), so that it can improve cognitive function.<sup>4,9,10,12</sup>

## CONCLUSION

The intervention giving in the form of reading books aloud influenced the episodic memory function in the study subjects which was marked by an increase in the episodic memory post-test score in the intervention group.

Further research needs to be carried out by controlling external factors that can be biased that affect the results of the study, besides that it is necessary to have research with a wider scale of research so that the research results are not only limited to the elderly group that has been studied only and the duration of the study is in the long term. longer time so we can find out more about the effect of giving intervention if the duration of the study is carried out in a longer period of time.

## REFERENCES

1. Dharani, K. and Dharani, K. Chapter 3- Memory', *The Biology of Thought*. 2015;pp. 53-74. doi: 10.1016/B978-0-12-800900-0.00003-8
2. Fisher, G. G., Chacon, M. and Chaffee, D. S. *Theories of Cognitive Aging and Work, Work Across the Lifespan*. Elsevier Inc. 2019; doi: 10.1016/b978-0-12-812756-8.00002-5.
3. Konar, A., Singh, P. and Thakur, M. K. Age-associated cognitive decline: Insights into molecular switches and recovery avenues, *Aging and Disease*, 2016;7(2): 121-129. doi: 10.14336/AD.2015.1004.
4. Voss, P. *et al.* Dynamic brains and the changing rules of neuroplasticity. Implications for learning and recovery', *Frontiers in Psychology*; 2017; pp. 1–11. doi: 10.3389/fpsyg.2017.01657.
5. Kweldju, S. Neurobiology Research Findings: How the Brain Works During Reading, *Pasaa*, 2015; 50, pp. 125-142. Available at: <https://files.eric.ed.gov/fulltext/EJ1088308.pdf>.
6. Djajasaputra, A. D. R. and Halim, M. S. Fungsi Kognitif Lansia yang Beraktivitas Kognitif secara Rutin dan Tidak Rutin, *Jurnal Psikologi*, 2019; 46(2): 85. doi: 10.22146/jpsi.33192.
7. Yoshida, H. *et al.* Do practices of learning activities improve the cognitive functioning of healthy elderly adults? From the viewpoint of a transfer effect , *Shinrigaku Kenkyu*, 2014; 85(2): 130–138. doi: 10.4992/jjpsy.85.13013.
8. Nouchi, R. *et al.* Reading aloud and solving simple arithmetic calculations intervention (Learning therapy) improves inhibition, verbal episodic memory, focus attention, and processing speed in healthy elderly people: Evidence from a randomized controlled trial, *Frontiers in Human Neuroscience*; 2016. pp. 1–14. doi: 10.3389/fnhum.2016.00217.
9. Chanraud, S. and Sullivan, E. V. Compensatory recruitment of neural resources in chronic alcoholism. 1st edn, *Handbook of Clinical Neurology*. 1st edn. Elsevier B.V; 2014. doi: 10.1016/B978-0-444-62619-6.00022-7.
10. Mateos-Aparicio, P. and Rodríguez-Moreno, A. The impact of studying brain plasticity, *Frontiers in Cellular Neuroscience*, 2019. pp. 1–5. doi: 10.3389/fncel.2019.00066.

11. Sörman, D. E., Ljungberg, J. K. and Rönnlund, M. Reading habits among older adults in relation to level and 15-year changes in verbal fluency and episodic recall, *Frontiers in Psychology*; 2018. pp. 1–10. doi: 10.3389/fpsyg.2018.01872.
12. Wang, Y. et al. Lifespan intellectual factors, genetic susceptibility, and cognitive phenotypes in aging: Implications for interventions', *Frontiers in Aging Neuroscience*; 2019. pp. 1–11. doi: 10.3389/fnagi.2019.00129.

