



THE EFFECT OF CLIMBING UP AND DOWNSTAIRS EXERCISE ON SHORT-TERM MEMORY AMONG YOUNG ADULTS (AGE 18-22)

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ABSTRACT

Background: Short-term memory affects academic performance. Good memory function is one of the benefits of physical exercise. A sedentary lifestyle and physical inactivity lead people to do less exercise. Climbing up and downstairs is one form of practical physical exercise that can be easily done anywhere at any time and by anyone. **Aim:** To assess the effect of climbing up and down stairs exercise on short-term memory in young adults. **Method:** This research used Quasi-Experimental with pre-test and post-test non-equivalent group method. Subjects were medical students of the Faculty of Medicine, Diponegoro University (n=40) aged 18-22 years that meet the inclusion criteria. Subjects were divided into 2 groups, control group (CG) and exercise group (EG), each consisting of 20 people. The subject's short-term memory was assessed using the Scenery Picture Memory Test (SPMT). Statistical analysis with Shapiro-Wilk test, paired T-test, Wilcoxon, independent T-test, and Mann-Whitney. **Result:** There were significant improvements in short-term memory before and after climbing up and down stairs exercise on both exercise group (p=0.000) and control group (p=0.001). No difference in pre-test scores between groups (p=0.921), and a significant difference in post-test scores between groups (p=0.010). An Independent T-test was done on the delta of the pre-post test between groups and is significant (p=0.016). **Conclusion:** 6 weeks of climbing up and down stairs exercise improves short-term memory in young adults. A higher improvement was found in the exercise group.

Keywords: Exercise, short-term memory, climbing up and down stairs exercise, Scenery Picture Memory Test (SPMT).

BACKGROUND

Memory is a cognitive function that makes humans have the ability to learn, remember, and interact with people around them.¹ Memory is very important for human life, especially for young adult students who are still pursuing education. But the trend of physical inactivity and a sedentary lifestyle can disrupt the memory storage process which will have an impact on students academic performance.²

Many studies show that exercise or physical exercise has positive effects on improving cognitive functions.³⁻⁶ Based on oxygen usage, physical exercise is divided into aerobic and anaerobic.⁷ The short-term effects of aerobic exercise have been

hypothesized to facilitate cognitive performance, including short-term memory through several mechanisms: increased level of *Brain-Derived Neurotrophic Factor* (BDNF) and *Insulin-like Growth Factor-1* (IGF-1).^{8,9}

METHOD

This study used a Quasi-Experimental design with pre-test and post-test non-equivalent group method. The study was conducted on 40 male students of the Faculty of Medicine, Diponegoro University, which were divided into two: control group (CG) and exercise group (EG), with 20 people each group. Subjects



were selected based on inclusion and exclusion criteria.

The EG received an exercise of climbing up and downstairs for 6 weeks with 3 sessions each week. The CG was not given any exercise and asked not to vary their daily activities. Short-term memory was assessed using the Scenery Picture Memory Test. A higher value indicates a better short-term memory function.

Data analysis includes descriptive analysis and hypothesis testing. Data normality was analyzed with the Shapiro-Wilk test for samples are less than 50 subjects. The pre-post test of each group was analyzed using the paired T-test for CG, and the Wilcoxon test for EG. Intergroup pre-test data were analyzed using the independent T-test, and intergroup post-test data were analyzed using the Mann Whitney test. The significance value in this study is $p < 0.05$.

RESULT

This study was conducted on 40 male students of the Faculty of Medicine Diponegoro University. Research subjects who met the inclusion criteria were grouped using the Matched Subject Ordinal Pairing (MSOP) technique into 2 groups, namely, exercise group (EG) that performed climbing up and down stairs exercise and control group (CG) that did not receive exercise. As shown in Table 1, the average age of the research subjects was 19.75 years

old with the youngest age was 18 and the oldest age was 21. Subjects had an average height of 168.41 cm, an average weight of 62.42 kg, and an average Body Mass Index (BMI) of 21.98.

Short-term memory function was measured twice: before the exercise group was given the intervention, and after 6 weeks of the intervention was given.

The result in table 2 shows significant increases in short-term memory in both CG ($p=0.001$) and EG ($p=0.000$). Intergroup test to compare the pre-test of both groups shows no significance ($p=0.921$), while intergroup test to compare the post-test of both groups shows significance ($p=0.010$). Delta test to measure the difference of pre-post test of CG and EG shows significant a difference ($p=0.016$), indicating the increase of short-term memory in EG is higher than CG.

DISCUSSION

This study provides results that indicate the effect of climbing up and downstairs for 6 weeks on short-term memory in young adults. Based on statistical analysis, significant increases in short-term memory were found in both groups. Furthermore, the delta of the pre-post test of both groups was analyzed, results in a significant difference, showing that improvement of short-term memory in EG is higher than CG.

Table 1. Research Subject Characteristics

Parameter	N	Minimum	Maximum	Mean \pm Standard Deviation
Age (year)	40	18	21	19.75 \pm 0.95
Height (cm)	40	147	178	168.41 \pm 5.33
Weight (kg)	40	49	77.5	62.66 \pm 7.31
Body Mass Index (kg/m ²)	40	18.69	25	22.12 \pm 1.99



Table 2. Statistical Analysis of Assessed Short-term Memory

Short-term Memory	Group		p
	Control (CG) (Mean±SD)	Exercise (EG) (Mean±SD)	
Pre	15.37 ± 3.30	15.35 ± 3.08	0.921 [§]
Post	17.84 ± 2.57	20.05 ± 2.37	0.010 ^{‡*}
p	0.001 ^{¶*}	0,000 ^{w*}	
Difference (delta)	2.47 ± 2.87	4.7 ± 2.62	0.016 ^{§*}

Description:

* = Significance value ($p < 0,05$); [¶] = Paired T test; ^w = Wilcoxon; [§] = Independent T test [‡] = Mann Whitney

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The results of this study are in line with previous studies which state that doing skipping for 8 weeks improved short-term memory,² and improved short-term memory after acute brisk walking exercise.¹⁰ An underlying mechanism is known that connected physical activity and improvement in cognition is through an increase in Brain-Derived Neurotrophic Factor (BDNF).⁸

BDNF acts by modulating neuronal plasticity, inducing neurogenesis, and increasing hippocampal volume.^{11,12} Increase in BDNF will result in better cognitive performances, including memory function.¹³ Studies on rodent subjects show increased BDNF expression in cortex and hippocampus after physical exercise.¹⁴ Cortical BDNF and serum BDNF are closely related, thus, serum BDNF can act as

a proxy for cortical BDNF.¹⁵ Studies on humans confirmed there was increased serum BDNF after exercising.^{9,16} It is also stated that the increase in spatial memory and anterior hippocampal volume is related to increased serum BDNF.¹²

Meanwhile, a significant increase in short-term memory was also found in the control group. This can occur as a result from the repetitive measurement of short-term memory using the same instrument (Scenery Picture Memory Test), in line with a study which stated that there will be a tendency of improvement in test score on subjects given the same test more than once.¹⁷ Although the control group shows a significant result, improvement in the exercise group is higher, as shown by statistical analysis of the delta test which was significant.

CONCLUSION

Conclusion

There was a difference in short-term memory as measured by the Scenery Picture Memory Test (SPMT) between the treatment group and the control group before and after the training sessions.

Suggestion

Further research needs to be done in a conducive environment so the subjects can be more focused and concentrated on the



test. It is also necessary to test this exercise on more subjects from different backgrounds. Finally, it is necessary to do further research on stairs of different sizes and heights to find out if there are different changes in short-term memory after climbing up and downstairs with different stair specifications.

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