

Improving Cognitive Function Through High Intensity Interval Training in Sedentary Healthy Young Adults

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Abstract:- Regular exercise and physical activity can reduce the risk of chronic illness and death while also improving body composition and cardiorespiratory performance. Compared to conventional training approaches, high intensity interval training is an effective and time-saving training strategy to improve fitness on young adults. On the other hand, little is known about how they affect cognitive function. As of right now, there are no recommendations for physical activities that enhance cognitive function. Thus, the purpose of this research was to ascertain how HIIT affected young adults who were sedentary in terms of cognitive function. The method of this study used an experimental method on 20 sedentary young adults. Samples were divided into two groups, the control group and the HIIT group. HIIT sessions consisted of intervals of 60 second work at 85% HRmax and 120 second interval period at 40% HRmax, three times/wk for four weeks. Cognitive function was measured using the stroop task test. The results showed that there were a significant increase in cognitive function in the HIIT group ($p=0.00$). There were a significant difference in cognitive function between the HIIT and the control group ($p=0.00$). In conclusion, HIIT over four weeks can increase cognitive function in sedentary young adults.

Keywords:- High-Intensity Interval Training, Cognitive, Adult.

I. INTRODUCTION

Physically inactive is currently the fourth largest risk factor for death worldwide [1], which raises major health concerns for individuals of all ages. Based on WHO guidelines regarding physical activity (PA), young adults should engage in moderate-to-vigorous aerobic PA for at least 60 minutes each day [2]. Young adults who regularly engage in physical exercise can benefit from a variety of physical health outcomes, such as improvements in cardiorespiratory fitness, body composition, physical capacity, and decrease blood pressure [3]. Even though the benefits of physical activity were known, there were 80% of people who do not meet WHO activity guidelines [4]. Moreover, review-level data indicates that during adolescence, physical activity levels decrease by about 7% year [5]. Nevertheless, the majority of attempts to promote physical activity among young adults have failed, and there is an urgent need to find quick and

creative ways that can have a significant positive impact on youth health [6].

When compared to standard training approaches, high intensity interval training (HIIT) has shown to be an innovative and efficient way for increasing adolescents' health-related fitness. HIIT alternates brief high intensity PA bouts with passive rest intervals. It's been demonstrated that HIIT maximizes the benefits of exercise in the little time allotted for PA practice [7]. It is commonly known that HIIT has positive effects on health at every age, even for young adults. Physically, the ongoing implementation of HIIT improves participant ratings of their own perceived exertion (based on the Borg's scale), cardiorespiratory fitness, heart rate, and muscle mitochondrial adaptations [8].

The primary attraction of HIIT was its ability to produce similar physiological adaptations in a shorter amount of time than traditional aerobic training. With comparable adherence rates, high-intensity interval training (HIIT) is a viable substitute for moderate-intensity continuous training, also known as traditional endurance training [9]. However, HIIT leads to more improvements in cardiorespiratory fitness in young, middle-aged, and older individuals [10] in healthy people [6] with less time commitment [11]. One of the biggest barriers to exercise has been identified as a lack of time.

Better cognition in young adults has been linked to higher levels of PA [12]. The result of the study showed that physical activity with high intensity had higher cognition than low intensity[13]. However, high-intensity exercise has been shown in individuals looking for quick fixes to improve cognitive function, like young adults who are frequently confined to sedentary learning environments. It has been shown that even after just one session, HIIT improves cognitive function in healthy adults [14]. HIIT might offer young people an efficient stimulus to enhance their cognitive abilities. Nevertheless, there is little data from intervention trials regarding how PA affects young adults' cognitive abilities. Moreover, a single HIIT session has been shown to enhance adult cognitive control, and the findings of certain research indicate that HIT has favorable effects on brain oxygenation and cognition [15].

The aim of the study was to determine the effect of HIIT on cognition function in sedentary young adults.

II. RESEARCH METHOD

A. Study Design

The research was conducted in a quasi experimental design. This study compared the cognitive function of sedentary young adults who received HIIT and control for four weeks. Anthropometric measurements, cognitive function, and physical exercise were carried out at the Physiotherapy Laboratory, Abdurrah University from Juny to July 2023.

The inclusion criteria of this study were age 18-24 years. Exclusion criteria were students who did strenuous exercise twice per week for ≥ 30 minutes and students who reported illnesses including trauma, injury, kidney, heart, liver disease, and diseases that required the use of steroids such as asthma, inflammation/disorders immune or hospitalized within the previous three months.

B. Test Procedures

BMI used anthropometric measurements, body weight (BB) is measured using digital scales with the Omron brand

and height (TB) is measured using a stadiometer. The equipment used for cognitive test includes Stroop Task Test forms.

C. HIIT Procedures

Subject carried out familiarization first to get used to walking on the treadmill for one minute. The intensity used in HIIT was 85% for high intensity and 40% for interval periods or low intensity. HIIT was given for 20 minutes with 60 seconds for high intensity and 120 seconds for low intensity. After stopping exercise on the first and end of exercise, cognitive function was measured.

D. Statistical Analysis

Statistical analyzes were performed using the IBM SPSS Statistics Program version 24, IBM, US. The Shapiro–Wilk test was used to verify data normality. Paired t-test and independent t-test were used to analyze cognitive function scores. The value of $P < 0.05$ was used as a criterion for statistical significance.

III. RESULTS

At baseline, there was no significant difference in anthropometric measured between both groups (Table 1).

TABLE I. PRE- AND POST-TRAINING PARTICIPANT DATA VALUES FOR ANTHROPOMETRIC

	Control		HIIT	
	PRE	POST	PRE	POST
Age	19,6±1,17		19,7±1,33	
Height (m)	1,58±0,06		1,63±0,09	
Gender	7 F, 3 M		7 F, 3 M	
Weight (kg)	55,8±6,76	56,1±7,14 ^a	62,9±16,6	62,6±16,2 ^a

Note. M, meters; kg, kilograms; F, Female; M, Male
^a Statistically different from PRE, $p < 0.05$.

TABLE II. COGNITIVE RESPONSES TO TRAINING INTENSITY IN CONTROL AND HIIT GROUP

Stroop Task	Control		HIIT	
	PRE	POST	PRE	POST
Set A (sec)	12,1±1,52	13,00±1,24	12,1±1,37	9,2±1,81 ^{ab}
Set B (sec)	11,9±1,6	13,2±1,5	11,6±1,43	9,7±1,16 ^{ab}
Set C (sec)	22,3±3,65	23,9±3,31	22,6±1,43	18,5±1,16 ^{ab}
Set D (sec)	31,3±8,11	33,3±7,93	29,8±5,51	25±4,98 ^{ab}

Note: Values are expressed in mean \pm SD; sec, seconds; HIIT, high intensity interval training. Compared with PRE HIIT training:
^a $p < 0.05$, Compared to Control Group ^b $p < 0.05$.

Based on table II, we found that time were shorter after HIIT than before HIIT. There were significant differences on cognitive function between control and HIIT group ($p < 0,05$).

cognitive performance, and only those in the HIIT group showed improvement.

IV. DISCUSSION

The purpose of this research was to assess how HIIT affected young adults who were sedentary in terms of cognitive function. The findings support the notion that HIIT can enhance young adults' cognitive function who are sedentary. The Stroop task was used to gauge subject

Based from these results, we propose that there is potential evidence to support the positive effects of short-term, high-intensity exercise on adult cognitive function. Research suggests that higher intensities should produce greater improvements in cognition [16]. It has been demonstrated that the intensity of exercise influences the relationship between exercise response and inhibition. HIIT yielded the best results. Most research has concentrated on molecular and cellular interactions as well as structural and

functional changes in the brain in an effort to explain the underlying mechanisms of the aforementioned findings and increase our understanding of the relationship between exercise and cognition. [7].

High-intensity exercise has been demonstrated of research to stimulate the release of neurotrophic factors, including Brain Derived Neurotrophic Factor (BDNF) [17]. It is implied that after acute exercise, BDNF mediates cognitive enhancement [18]. Winter and colleagues [16] tested the impact of short-term exercise on BDNF serum levels and HIIT-based learning. It was discovered that the HIIT group had higher levels of learning success, and that these higher levels were associated with higher serum levels of BDNF.

The findings imply that exercising at a high intensity can improve executive function [19]. It has been suggested that increased concentrations of a number of neurochemicals, including BDNF and catecholamines (such as dopamine and adrenaline), produced by exercise, especially high-intensity exercise, may enhance cognitive performance, even though the mechanisms underlying these effects are not fully understood [20]. These findings imply that HIIT was successful in producing cognitive advantages with time-efficient strategy.

V. CONCLUSION

Based on the results of the research above, high intensity interval training (HIIT) method has a great influence on the cognitive function in sedentary young adults. HIIT method three times per week can be used as a way to increase cognitive function in sedentary young adults.

ACKNOWLEDGMENT

This research was funded by Hibah Program Penelitian Direktorat Riset, Teknologi dan Pengabdian Kepada Masyarakat (DRTPM) 2023

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