



Kusumaningtyas Ayu Amarihati, Yosef Purwoko,
Ferdy Kurniawan Cayami, Endang Kumaidah

DIFFERENCE IN BODY'S DYNAMIC BALANCE BEFORE AND AFTER CONDUCTING CIRCUIT TRAINING OF STUDENTS AT MEDICAL FACULTY OF DIPONEGORO UNIVERSITY

Kusumaningtyas Ayu Amarihati¹, Yosef Purwoko², Ferdy Kurniawan Cayami³, Endang Kumaidah²

¹Undergraduate Student, Faculty of Medicine, Diponegoro University

²Lecturer, Department of Physiology, Faculty of Medicine, Diponegoro University

³Lecturer, Department of Anatomy, Faculty of Medicine, Diponegoro University

*Correspondence Author Email: kusumaningtyas98@gmail.com

ABSTRACT

Background: Physical inactivity that happens recently increase the risk of various disease. Circuit training is an exercise that can be completed with a short amount of time and has varied movements. With circuit training, subject expected to have increase in physical fitness in the body's dynamic balance. The purpose of this study to find out whether circuit training can produce different scores of the body's dynamic balance of students at medical Faculty of Diponegoro University. **Methods:** This study used a quasi-experimental design with pre-test and post-test comparison group. The subjects were from the Medical Faculty of Diponegoro University (n = 46) which were divided into control group and treatment group. The treatment group (n = 24) was given circuit training for 6 weeks with increased number of circuits for every 2 weeks, while the control group (n = 22) carried out activities as usual without doing any sports. The measuring of body's dynamic balance was carried out before starting circuit training and after completing 6 weeks of circuit training. Data were collected and then analyzed using the unpaired T-test and the paired T-test for normally distributed data. Meanwhile, the Mann-Whitney test and Wilcoxon test were used for non-normally distributed data. **Results:** The score of the body's dynamic balance in the treatment group increased for the right leg with a pre-test score of 75.60 ± 13.74 to 95.75 ± 10.98 . The balance score for the left leg also increased with the pre-test score of 78.05 ± 13.12 to 95.95 ± 10.33 . The score of the difference between the post-test and pre-test of the treatment group of both legs has a significant value of ($p = 0,000$). **Conclusion:** Circuit training with increased number of circuits for every 2 weeks can increase the scores of the body's dynamic balance of of students at medical faculty of Diponegoro University.

Keywords: *circuit training, body's dynamic balance, Y balance test*

INTRODUCTION

Among 300.000 household samples in Indonesia, there are 33,5% people with age over 10 years old were experiencing problem of lack in physical activity stated by The Indonesian Ministry of Health in 2018.¹ Changes of lifestyle that happen in Indonesia, as such caused by advances in information technology and transportation are important factors in the decline of physical activity in the community. This lack of activity could lead to many disease like coronary heart

disease, diabetes, high blood pressure, obesity, depression, and improve lipid profile.^{2,3}

Circuit training is a sport that can be completed in less than 10 minutes for each circuit and it can be done in groups.⁴ The training method consists of several stations or posts and with each station having different exercises. The effectiveness of time and the variety of exercises in the circuit training are suitable for people with lack of physical activity problem. Previous



researches have mentioned that circuit training is said to improve cardiovascular health, build muscle, as well as reduce the amount of fat.^{5,6} Circuit training with additional training features can be used as an alternative and low-cost method for physiotherapy for healing lower motoric extremities as well as balance and endurance in walking for sub-acute stroke patients.^{7,8}

The circuit training movements can improve balance through a variety of mechanisms. Movements that use variations with many stations in a short time will train the sensory integration of the body because they require a combination of work among the vestibular, visual, and somatosensory systems.^{9,10} Exercises involving alternating movements of both legs that are carried out quickly and repeatedly will stimulate the vestibular nucleus pathway repeatedly that will speed up the reaction time of spreading bodily position signals (proprioceptive) towards the brain. This eventually will stimulate the body's response to stop movement and also make further movements becomes faster. Exercises that are carried out continuously will also lead to physiological adaptations such as an increase in the size of muscle fibers (muscular hypertrophy) and the diameter of muscles.¹¹ Greater diameter of muscles will provide better muscle endurance and strength. The circuit training movement is also focused on strengthening the muscles of the lower extremities which function to maintain body balance.¹²

Knowing that there is a relationship between circuit training and increased body's dynamic balance and that no article has been found that discusses relationship is the reason for conducting this research. This research wants to show differences in the body's dynamic balance before and after conducting circuit training.

METHODS

This research used a quasi-experimental design of two groups with pretest and posttest. The treatment group was given circuit training for 6 weeks with increased number of circuits for every 2 weeks, while the control group was given no treatment. The inclusion criteria of the subjects were male, aged 18-22 years, having a normal BMI, and willing to not do sports other than circuit training for 6 weeks. Athletes, people with a history of persistent lower extremities disease, people with abnormal posture, and people with a history of brain injury cannot become the subject of this research. At the beginning of the research, as many as 46 people were selected. They were divided using the purposive sampling method into 24 people for the treatment group and 22 people for the control group. Then, all subjects were given an informed consent sheet containing the ethical criteria provided by the Health Research Ethics Commission (KPEK) of Medical Faculty of Diponegoro University or Dr. Kariadi Hospital. This research has received ethical clearance from KPEK with its number 153/EC/KEPK/FK-UNDIP/V/2019.

In the treatment group, circuit training was done with 3 exercises per week and an increase in the number of circuits for every 2 weeks. The circuit training movement for 1 circuit performed was jumping jacks, wall-sit, step-to-chair, squats, planks, lunge, high knees, and mountain climbers. Each exercise was done with duration of 30 seconds and followed by 30 seconds of break. The measuring of body balance was done before starting the circuit training and after completing the exercise for 6 weeks using the Y Balance Test. The data were then collected and processed using SPSS. Balance scores in the control and treatment groups were compared using the



unpaired T-test or the Mann-Whitney test. Pre-test and post-test scores were tested using the paired T-test or the Wilcoxon Test. Differences are considered significant if the p value <0.05.

RESULT

The subjects of this research consisted of 22 students from Medical Faculty of Diponegoro University for the control group and 24 students for the

treatment group. There were 4 students from the treatment group who drop-outs. Differences in characteristics such as age, weight, height, and BMI do not influence the the balance score. None of the treatment and control groups had a history of extremity injury, a history of brain injury, or were in the treatment period. Therefore, they did not affect the final scores of the body's dynamic balance.

Table 1. Characteristics of the participants

Variable	Group		P [^]
	Treatment	Control	
- Age (years)	18,95±0,75	20,45±0,59	0,282
- Weight (kilogram)	62,80±0,76	62,05±8,44	0,855
- Height (centimeter)	170,250±5,24	167,5±4,85	0,198
- BMI	21,65±1,78	22±2,30	0,158
- Exercises frequent			
a. Yes, once or more in a week	15 (75%)	14 (63,6%)	
b. No, less than once in a week	5 (25%)	8 (36,4%)	
- Persisting extremity injury			
a. Yes			
b. No	20 (100%)	22 (100%)	
- Brain injury history			
a. Yes			
b. No	20 (100%)	22 (5100%)	
- On medication tratment			
a. Yes			
b. No	20 (100%)	22 (100%)	

The table shows Means±Standart Deviation; % for frequencies of the participan, P[^] for the correlation test

The body's dynamic balance of the subjects were measured twice during the pre-test and post-test using the Y Balance Test. They were calculated in two measurements which were the left leg and right leg. In the treatment group, both the left leg and right had increased pre-test and post-test scores.

The pre-test scores of the two groups had significant results (p = 0.001) because the spread between the pre-test score of the two groups varied. For the post-test score, it can be seen in that the treatment group had increased with a high number while the control group had increased with low number



or even decreased, so that the post-test scores of the treatment group and the control group are almost at the same point; the results obtained are not significant ($p = 0.216$). For the differences in pre-test and post-test scores the two groups got a significant result that is

$p = 0,000$, which means there is a difference in the score of the control group and the treatment group.

Table 2. The Scores of Body's Dynamic Balance of Both Groups on Right Leg

Balance Score	Control Group (n=22)	Treatment Group (n=20)	P [†]
Pre-Test	90,82±11,76	75,60±13,74	0,001*
Post-Test	91,36±7,74	95,75±10,98	0,216
P [†]	0,848	0,000*	
Difference in Pre-Test and Post-Test	0,77±12,39	20,00±9,42	0,000*

Table shows P[†] = for Wilcoxon test, P[‡] = Mann-Whitney test, * = the result is significant ($p < 0,05$)

Table 3. The Scores of Body's Dynamic Balance of Both Groups on Left Leg

Balance Score	Control Group (n=22)	Treatment Group (n=20)	P [§]
Pre-Test	95,36±11,27	78,05±13,12	0,000*
Post-Test	90,86±8,81	95,95±10,33	0,093
P [¶]	0,083	0,000*	
Difference in Pre- Test and Post-Test	-4,32±11,48	17,90±9,88	0,000*

Table shows P[¶] = Paired T Test, P[§] = Independent T Test, * = the result is significant ($p < 0,05$)

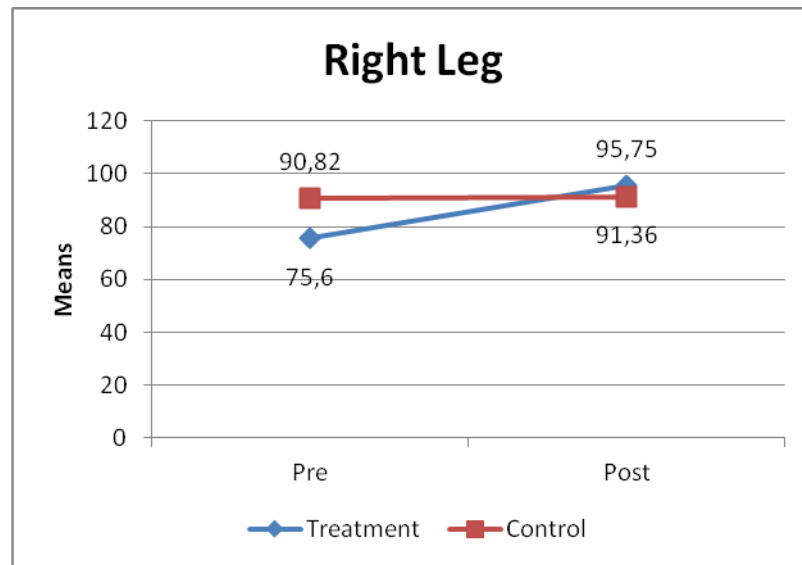


Figure 1. The Scores of Body's Dynamic Balance on Right Leg

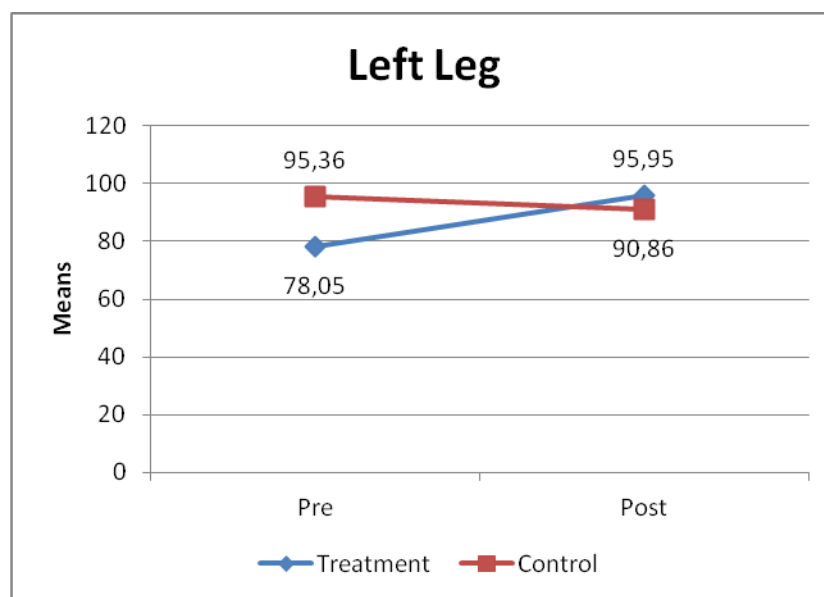


Figure 2. The Scores of Body's Dynamic Balance on Left Leg

From this research, it can be concluded that circuit training improves the body's dynamic balance as can be seen statistically in an increase of the pre-test and post-test scores of the treatment group. Difference in pre-test and post-test scores for the two groups also obtained significant

results $p = 0.001$, which shows that circuit training in the treatment group can improve the body's dynamic balance.

Circuit training uses physical training mechanisms that are carried out sequentially and repeatedly. Repeated exercises can increase the reaction time and physiological



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functions of the body to be more optimal. Previous research on the circuit training program explained that the benefits of this exercise are that it can reduce fat storage and increase insulin resistance at a young age in overweight/obese Latino.¹³ In research by M. Al-Haliq, it is stated that circuit training can have an effective impact on the development and improvement of the physical fitness aspect.¹⁴

There were some shortcomings of this research as the number of subjects experiencing drop outs reached a maximum limit, so that the number of subjects in the treatment group was less than those in the treatment group. The exercises for the treatment group were done during the fasting month, so this may provide result bias because not all subjects were fasting. Also, there was lack of supervision for exercises of both groups and nutrition intakes of both groups.

CONCLUSION AND SUGGESTION

Conclusion

In accordance with the initial objective of the research, there are differences in the scores of the body's dynamic balance before and after conducting circuit training. The specific objective is in accordance with the results of the research that there is a difference in the score of the body's dynamic balance after conducting circuit training between the control group and the treatment group.

Suggestion

This research can later be developed further with different subjects, such as those in adulthood. In adulthood, humans tend to experience a decrease in the score of balance. Development in dependent variables of research can be done by examining other things or comparing circuit training with other exercises. Monitoring for exercises and

food intakes for subjects can also be more maintained.

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