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Balanced physical exercise increase physical fitness, optimize endorphin levels, and decrease malondialdehyde levels

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ABSTRACT

Background: Physical fitness determines the level of human health. A good physical fitness can be achieved if conducted with a balance and active physical fitness. The aims of this study was to elucidate the effect of balanced physical exercise on physical fitness, endorphin levels, and malondialdehyde (MDA) levels.

Methods: This study was a true experimental with pretest-posttest control group design using 24 students of IKIP PGRI Denpasar. Selected samples divided into two groups: the control group given conventional physical training (P0) and the treatment group given balanced physical training (P1). Physical fitness tests was performed using Cooper method and blood sampling was done to evaluate the level of endorphins and MDA before (pre test) and after (post test) treatment of 8 weeks. The data of endorphin and MDA levels were analyzed using *independent T* test. Whereas, the physical fitness was analyzed using *Mann-Whitney U* test.

Results: Physical fitness of the group given a balanced physical training was significantly higher compare to the group given a conventional physical training ($p < 0.05$). Balanced physical training was proven to enhance physical fitness as measured by the Cooper method better than conventional physical training. In contrast, the levels of endorphins of the balanced physical training group did not different with the conventional physical training group ($p > 0.05$). Levels of MDA of balanced physical training group also did not different with the conventional physical training group ($p > 0.05$).

Conclusions: Balanced physical training can maintain physical fitness of people and improve the health and quality of life.

Keywords: balanced physical training, physical fitness, endorphins, MDA.

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INTRODUCTION

Good physical fitness can only be achieved if conducted with active and balanced physical exercise. Physical exercise is conducted to improve the function of the body in order to fulfill the body need optimally when do exercise.[1] Physical training which conducted actively and regularly in accordance with scientific principles will maintain the levels of hormones including sex hormones accompanied by the release of endorphins that will give a sense of fresh and excited to our bodies, so as to maintain bodies function better.[2]

Various reports indicate that the frequency, intensity, time, type (FITT) in sport determine the balance of body functions.[1,3] Imbalanced physical activity patterns are often and always occurr until today. The imbalance of exercise cause unbeneficial exercise or accelerated aging and death. Excessive physical activity will lead to the formation of free radicals and malondialdehyde (MDA), while the balance physical activity will not stimulate an increase in free radicals.[4] Free radicals can cause damage to the both nuclear and mitochondrial DNA, cell membrane, protein, lead to lipid peroxidation, and accelerate the aging process. The malondialdehyde augurs to assess free radicals in the blood. Measurement of free radicals in the body is very difficult due to unstable nature of free radicals, so its often measured indirectly through their derivative products such as MDA. The malondialdehyde is enzymatic and non-enzymatic product of prostaglandins breakdown, endoperoxide and the end product of lipid peroxidation.[5]

Physical activity will improve several hormones such as adrenaline, corticotropin releasing factor (CRF), and endorphins.[6] This is normal and these level will return to normal in a few times when activities are carried out within the bounds of reasonable according to the ability of the body's training zone. The release of endorphins by the pituitary gland causes a pleasant and excited feeling so that someone who is experiencing a period of endorphins is more eager to continue physical activity regardless of the condition of the body anymore.[3] This situation often experienced in the sports or in everyday life so that the athlete or non-athlete during exercise tend to do sports or other activities in excess.[7]

Therefore it is necessary to do balance physical activity in our everyday behavior since it is contributes in aging process and death. Should be observed that the stimulation by high concentrations of

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endorphins which tend to excessive physical activity that accelerates the aging process and fasten death. Physical activity both in sports and in everyday life should be done in a balanced and well-balanced physical activity must be patterned into a healthy lifestyle.[8] This study aimed to elucidate the effect of balanced physical exercise on physical fitness, endorphin levels, and malondialdehyde (MDA) levels.

MATERIALS AND METHODS

This study was an experimental study, using a randomized pretest-posttest control group design (Pocock, 2008). The subjects were male, physically and mentally normal based on medical doctor examination, aged around 18-30 years old, have a normal body weight with body mass index (BMI) within 18.5 to 23, and willing to be the subject of research. The subjects were divided into 2 groups: the control group were given conventional training (P0) and the treatment group were given balance physical exercise designed in accordance to exercise physiology (P1). The study was conducted by measuring physical fitness (Score Cooper), the levels of endorphin levels and MDA in the phase prior to study. Evaluation was done to all of the variables prior to the study (pre test) in order to determine the suitable training module based on exercise physiology in accordance with FITT to be performed to conventional training group (P0) and treatment group (P1). Training were then conducted for 8 weeks according to the groups. The measurement of variable after 8 weeks of training including measurement of physical fitness, the levels of endorphin levels and MDA were done (post test). The data obtained were analyzed using the *Mann-Whitney U* test for physical fitness and *Independent T*-test for endorphin and MDA.

Table 1 Cooper score comparison test

Data	Group	n	Cooper score	Quartile	U	p
Pretest	Conventional Physical Exercise (P0)	12	3.00	2.00-3.75	70.50	0.932
	Balance Physical Exercise (P1)	12	3.00	2.00-3.75		
Posttest	Conventional Physical Exercise (P0)	12	3.00	2.00-3.00	16.00	0.001
	Balance Physical Exercise (P1)	12	4.00	3.00-5.00		

Table 2 Comparison test of endorphins levels

Time	Data	Group	n	Mean (ng/mL)	SD	T	p
First day	Pretest	P0	12	0.195	0.04	3.155	0.005
		P1	12	0.145	0.03		
	Posttest	P0	12	0.168	0.06	0.184	0.855
		P1	12	0.163	0.06		
Last day	Pretest	P0	12	0.208	0.08	-0.494	0.626
		P1	12	0.228	0.11		
	Posttest	P0	12	0.176	0.07	0.636	0.531
		P1	12	0.152	0.07		

RESULTS

Physical Fitness

The median of Cooper score at first day in both groups was not different ($p > 0.05$), while at last day was significantly different ($p < 0.05$) (Table 1). From the results of this study, it can be clearly seen that a balanced physical exercise improve physical fitness better than conventional physical exercise (figure 1).

Levels of Endorphins

There was no difference of endorphins levels between conventional exercise group (P0) and balanced exercise group (P1) after treatment of 8 weeks ($p > 0.05$) (Table 2).

Levels of Malondyaldehide (MDA)

The test results of MDA level showed that the average MDA at the end of the eighth week in both groups after the treatment was not significantly different ($p > 0.05$) (Table 3).

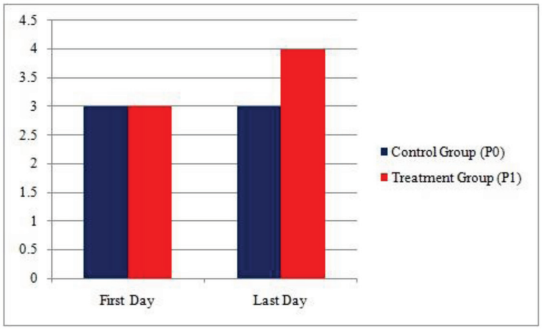

Figure 1 Cooper score comparison

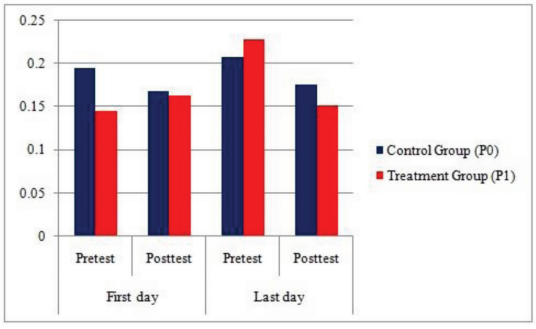

Figure 2 Endorphin level comparison

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Table 3 Comparison test of MDA levels

Time	Data	Group	n	Mean of MDA (μM)	SB	T	p
First day	Pretest	P0	12	0.300	0.05	0.048	0.962
		P1	12	0.290	0.11		
	Posttest	P0	12	0.347	0.07	0.074	0.942
		P1	12	0.351	0.12		
Last day	Pretest	P0	12	0.258	0.08	1.136	0.268
		P1	12	0.315	0.15		
	Posttest	P0	12	0.256	0.09	-0.392	0.699
		P1	12	0.273	0.12		

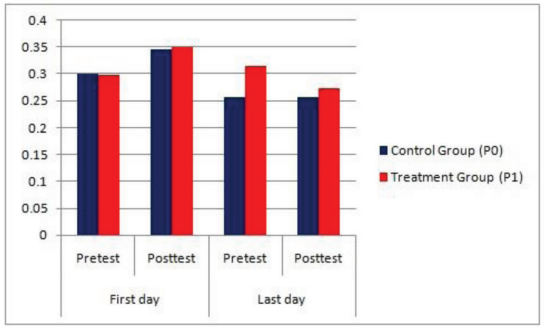

Figure 3 Malondyaldehide level comparison

DISCUSSION

The results of this study showed that the median of Cooper score at first day in both groups was not different ($p > 0.05$), while at the last day the median of Cooper score was significantly different ($p < 0.05$). It clearly shows that the balance physical exercise for 8 weeks could increase physical fitness represented by reducing time needed for run as far as 2.4 km, which are grouped into 5 category (1: very poor, 2: less, 3: medium, 4: excellent and 5: trained). The treatment group showed a median score of 4 and the control group showed a median score of 3.[9,10]

Improving of aerobic capacity on the physical training is highly dependent on the initial fitness level, intensity, frequency, and duration of exercise. Beside of these factors, in fact variation and types of training also determine the physical fitness. Bicycling apparently showed better improvement of physical fitness compared to treadmill.[11] In this study, both groups had an equal initial fitness level, frequency and duration of training. However, the treatment was different in case of intensity and type of exercise. The intensity of exercise was measured within training zone of 70-80% and the exercise type of aerobic training given to treatment group (P1) indicates a better of physical fitness compare to control group (P0) given conventional exercise of futsal. There was no increase in physical fitness in control group (P0) may be due to exercise intensity below the 70-80% zone. This result was supported by the fact that there was no change in resting pulse rate and exercise pulse rate despite been given treatment for eight weeks.

The result from this study showed that there was no difference of endorphins levels between conventional exercise group (P0) and balanced exercise group (P1) after 8 weeks of treatment ($p > 0.05$). These results implied that conventional exercise is able to maintain balanced training conditions in accordance with the ability of the body organ function monitored from cardiovascular function.

This balance training help the body maintain a withstand physical intensity, resulting in increased endorphin from rising too high, but according to the balance intensity.[12] This balance which can control the body so that the intensity of the exercise is not to reach excessive exercise. In contrast to the treatment group where the physical activity was not limited, but depends on the ability of the body. When endorphins increased due to increased physical exercise, our brains are triggered to an ever growing increase exercise intensity.[13,14] Spending is very triggered endorphins in the medium and high intensity.[15] But in this treatment group turned out to be an increase in endorphins in the treatment group was higher but not significantly. This condition indicates that the treatment group when performing physical activities do not impose themselves but still in accordance with his physical abilities in accordance with the exercise zone. So the group is still doing physical activity as much as possible but do not push themselves and not going through an uncomfortable situation.[16] Training for 8 weeks this causes the body is able to adapt to regulate the dispensing of endorphins.[13] But first there is a slightly different opinion that spending more endorphins triggered by anaerobic training than aerobic training (endurance) and an increase in endorphins increase after 1 hour.[17] Ten years later it was reported that spending endorphins occurs more in aerobic training than anaerobic training and has been an increase in physical training for 30 minutes.[18] Therefore, the physical examination was conducted for 30 minutes.

The effect of physical exercise on the response of endorphins is still being debated. One study reported no significant difference was found in a long training for 8 weeks. Other studies showed an increase of endorphins during physical exercise. Physical training can increase sensitivity to the effects of opioids, which in turn will reduce the amount of endorphins needed to give effect to the body. Regular physical training on the production of endorphins during physical activity will decline more slowly than the condition before physical exercise.[11]

Endorphin levels in the eighth week in the control group decreased after exercise from 0.208 ng/mL to 0.176 ng/mL, while in the treatment group from 0.228 ng/mL to 0.152 ng/mL. The comparison value of the final (post) endorphins at week eight was significantly different ($p < 0.05$), but the analysis of comparative differences in the final value and the initial value at week eight was not significant ($p > 0.05$) due to the initial value at week eight are different. These results indicate that the two groups were able to adjust to the physical capacity of their physical needs. This result was achieved by the control group did moderate physical activity (value 3) and the treatment group with the ability of physical activity is good (grade 4).[9,10] This condition can be achieved in the zone-intensity aerobic exercise (endurance) between 70%-80%.[3]

In this study, the average MDA end of the eighth week in both groups after the treatment was no different ($p > 0.05$). This situation is caused by the two groups when performing aerobic exercise is still in intensity (70% -80%).[19] It is in accordance with the conclusions of a research that regular physical activity and manipulation massage will lower the levels of MDA, increase SOD (superoxide dismutase), and glutathione.[20]

Endurance exercise in chronic exercise is more useful for lowering MDA than acute exercise.[20,21] In this study, both groups showed decreased levels of MDA but did not differ between treatment groups with the control group.

CONCLUSION

Based on the results of this study it can be concluded that balance physical exercise improve physical fitness better than conventional physical exercise, optimizing the endorphin levels but did not differ significantly compared with conventional physical training, and reduce levels of MDA but not significantly different compared to conventional physical training.

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