

ORIGINAL ARTICLE

The Effects of Acupuncture on the Resistance of the Cardiopulmonary, Fatigue Levels and Quality of Life

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ABSTRACT

Introduction: Fitness is a person's capability to carry out activities without feeling over exhausted. Automatic technological advances tend to reduce physical activities and motion mobilities that have an impact on physical fitness. According to basic health research in 2018, there was an enhancement in the number of people over 10 years of age who were less physically active in Indonesia, from 26.1% to 33.5%. Acupuncture is a treatment method to improve fitness in activities. **Methods:** This study was a pretest - posttest control group design. It was conducted for 4 weeks. Sample collection used random sampling method with a quota of 30 healthy male subjects who were divided into 2 groups. Acupuncture stabbing was performed at Zusanli ST-36 and Sanyinjiao SP-6 points. Cooper test was measured with VO₂ max, peak flow meter, Chalder Fatigue Scale and GHQ-12 results. Data analysis used paired t-test statistical test by comparing results of the pretest - posttest fitness after 12 treatments. **Results:** The study showed that the results of statistical analysis of pretest - posttest therapy group indicated of VO₂ max (p<0.05), peak flow meter value (p<0.05), Chalder fatigue Scale (p<0.05) and GHQ-12 (p<0.05). **Conclusion:** Acupuncture is effective in increasing Cardiopulmonary endurance, decreasing fatigue's level and keeping up the quality of life.

Keywords: Acupuncture, Fitness, Cardiopulmonary Endurance

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INTRODUCTION

Person's disciplinary attitude towards his own health is formed through health development effort. Improvement of physical fitness in the community need to be considered as a preventive effort. Currently people tend to be lazy because of the existence of modern technological facilities. Based on basic health research in 2018, there is an increase in the number over 10 years of age people who were less physically active in Indonesia from 26.1% to 33.5% (1). One's less physical activities result in influencing one's physical fitness (2).

Physical Fitness is one's ability and capability in trying to do activities without feeling tired significantly. Having good physical condition, one's productivity will increase too (3). Assessing one's physical fitness can be done by measuring cardiopulmonary endurance VO₂ max by cooper test method. In addition to cooper method, peak flow meter can also be used because a fit person also has strong breathing muscle (4). To measure

one's fatigue scale, *Chalder's Fatigue Scale* (CFS) is used. CFS is used to measure the rate of mentally fatigue (5). Bad mental condition can influence fatigue scale. To measure the level of depression and anxiety can be known by some questions mentioned in General Health Questionnaire-12 (GHQ-12) (6). Person's top cardiopulmonary endurance happens in the age of 20-30 years and continuously it will decrease 8-10% per decade if one doesn't do exercise regularly. The decrease of cardiac muscle contraction, vital lung capacity, cardiac muscle mass, and skeletal muscle capacity, they all can influence the decrease of physical condition (7).

The 2018 Sport Development Index (SDI) showed the Indonesian's percentage of achievement index of social participation in sport was 0,34 (34%) which is meant in minus category. It is only 34 persons who were active in sport within 100 persons (1). Physical unfit become the top death result in America in which nearly one million person death of hard and blood vessels disease (8).

Physiological difference between man and woman can affect the level of physical fitness. In general man has stronger muscle compared with woman. This caused by the existence of andro genetic hormone within man's bodies. In the same age category, woman's aerobic

ability is around 20% lower than men. This is happened caused by the hormonal difference which can result woman's hemoglobin concentration is lower and it is supported by big amount of fat in the body. Since in the age of 10 years the number of VO_2 max of boys 12% higher than girls. In the age of 12, change into 20% and then it become 37% in the age of 16 (9).

People consume more high energy drink and supplement tablet food contains amino acid for increasing fitness. High energy drink and supplement tablet of amino acid which are consumed by people in low dose have negative effect that is the increase of albumin excretion and result in the function of kidney disorder if it is consumed in high dose (10).

Acupuntur therapy can be used to lessen the negative effect supplement which meant to measure the fitness and to overcome fatigue appeared by psychic factor as well as the lactic acidosis in blood. Research had been done to the elite basketball player using acupuncture point *Neiguan* PC-6 dan *Zusanli* ST-36. The result of the research showed that acupuncture can decrease lactic acidosis after exercise (11). Case study related to the measuring of fitness by acupuncture method on *Zusanli* ST-36 dan *Sanyinjiao* SP-6, Gotu Kola leaves (*Centella asiatica*(L.).URB.) also liquorice root (*Glycrrhiza glabra* L.) found out that acupuncture therapy which is combined with herbal can increase VO_2 max (9).

This research is aimed at knowing the effectivity of acupuncture on the point *Zusanli* ST-36 and *Sanyinjiao* SP-6 toward cardiopulmonary endurance, level of fatigue and quality of life. Acupuncture needle stabbing on *Zusanli* ST-36 will stimulate the *nitric oxide* (NO) production. NO comes from eNOS on vascular wall which functions as oxygen and carbon dioxide transportation by reacting with hemoglobin from red blood cell. Oxygen complex with hemoglobin will be through out all the body by red blood for metabolism. Beside that red blood cell will also bring carbon dioxide back to the lungs (12,13). NO can also affect blood circulation increase as a result of vasodilation of blood vessel. This rising of blood flow will prevent Lactic asidosis which stay in the blood will flows smoothly toward liver, cardio, skin for reprocessing (14).

The other work mechanism of acupuncture from point *Zusanli* ST-36 and *Sanyinjiao* SP-6 is the appearance of analgesic effect which is affected by stimulation of the acupuncture point in which it happened the release of *endorphin*, *norepinephin*, *serotonin*, or *γ-amino butyric acid* (15).

MATERIALS AND METHODS

This research used pre-post therapy analytic comparative design method that compare cardiopulmonary endurance, fatigue level and quality of life whether before and after acupuncture. Affordable population on this study were 20-30 years old healthy male subjects, who were not athletes but did physical exercise regularly and lived in Surabaya, Indonesia. Samples that meet these criteria were asked to fill out inform consent voluntary (without coercion) then randomized into 2 groups by simple random sampling method using coin namely control group and treatment group. Coin with picture side would become treatment group while figure side become control group. This research involved 30 subjects, in which the number of subjects was obtained from the calculation of an unpaired numerical analytic formula, two groups, twice measurement with 95% confidence level and 1.22 of SD.

At the beginning of the research and the following 4 weeks, all subjects were asked to fill up the Chalder Fatigue Scale and GHQ-12 questionnaires, took VO_2 max measurements by using a peak flow meter, and conducted the running test as far as 400 meters (Cooper Test). The treatment group was given acupuncture therapy at *Zusanli* ST-36 and *Sanyinjiao* SP-6 points. The *Zusanli* ST-36 point was located on anterolateral side of the leg, the knee was flexed, 3 inches below the ST 35 Dubi (ST-35 dubi: the knee was in flexion, in the indentation below the knee, lateral to the patellar ligament), 1 finger lateral to the anterior tibial crest, whereas the *Sanyinjiao* SP-6 point was located at the at 3 cun above Malleolus Internus / Medialis, right on the posterior edge of the tibia (16). 0.25 x 25 mm accupuncture needle was inserted at this point by a medical acupuncturist until the sensation of the needling achieved then it was removed 30 minutes later. This acupuncture technique was done every 2 days for 4 weeks. Meanwhile the control group was not given any treatment.

The comparative hypothesis test for numerical variables with a normal distribution of two paired groups used the paired T-test, if the data distribution was not normal then use the Wilcoxon test. If the value of $p > \alpha$ means that there was no significant difference between compared variables, on the contrary if $p < \alpha$ means that there was a significant difference between compared variables. The statistical test was significantly considered if the value of $p < \alpha$ or $p < 0.05$. This research was conducted after passing the ethical study and approved by the Faculty of Dental Medicine Universitas Airlangga Ethics Committee. The subjects in this study enrolled voluntarily

by signing an informed consent that was confidentiality guaranteed.

RESULTS

This research was held for 4 weeks. Group of Subject's study was determined by purposive random sampling. There were 30 subjects study whose ages between 20-28 years and had 22.6 years as a mean age. None of them were absent during this study.

Table I : Characteristics of research subjects based on age

	N	Mean	Std. deviation	Minimum	Maximum
The treatment group	15	22.40	1.920	20	25
The control group	15	22.80	2.336	20	28
Total	30	22.60	2.111	20	28

Table II showed that before and after therapy in the treatment group had significantly difference of mean value ($p < 0.05$) among Cooper test results, Peak flow meter, Chalder Fatigue Scale and GHQ-12 questionnaire. While the control group, there was no difference ($p > 0.05$) of mean value among Cooper test results, Peak flow meter, Chalder Fatigue Scale questionnaire and GHQ-12 questionnaire before and after therapy. The initially mean value of Cooper test result was 37.21 and finally 39.27 after therapy ($p = 0.000$). Before therapy, mean of peak flow meter was 458 and 482 after therapy ($p = 0.000$).

Table II : Indicators comparison between group

	N	Treatment group			Control group		
		Mean	Std. Deviation	p	Mean	Std. Deviation	p
Cooper Pre-test	30	37.21	1.674	0.000	37.285	2.501	0.392
Cooper Post-test	30	39.27	1.906		37.073	2.367	
Peak flow meter pretest	30	458	51.851	0.000	448	30.284	0.055
Peak flow meter post test	30	483	51.362		436	34.365	
CFS pre test	30	13.33	3.374	0.000	12.93	2.549	0.710
CFS post test	30	19.67	3.638		12.73	3.770	
GHQ-12 pre test	30	13.40	3.112	0.000	12.87	3.114	0.716
GHQ-12 post test	30	10.80	2.513		12.53	3.777	

In the therapy group, the mean Cooper test result for the Chalder Fatigue Scale was 13.33 before therapy and 19.67 after therapy ($p = 0.000$). The GHQ-12 questionnaire had 13.40 mean value before therapy and 10.80 after therapy. While in the control group, main value of Cooper test result at the initial examination was 37.29 and 37.07 ($p = 0.392$) after 4 weeks. The mean

value of the peak flow meter at the initial examination was 448 and 436 ($p = 0.055$) after 4 weeks. Chalder Fatigue Scale mean value at baseline was 12.93 and the result after 4 weeks was 12.73 ($p = 0.710$). GHQ-12 questionnaire mean value at baseline was 12.87 and the examination result after 4 weeks was 12.53 ($p = 0.716$).

Table III : Comparison of the mean difference before and after therapy between groups

	N	Mean difference	Std. Deviation	P
The treatment group Cooper Post-Pre test	15	2.07	1.05	0.000
The control group Cooper Post-Pre test	15	-0.21	0.93	
The treatment group Peak flow meter Post-Pre test	15	25.33	14.57	0.000
The control group Peak flow meter Post-Pre test	15	-11.33	20.99	
The treatment group CFS Post-Pre test	15	6.33	1.68	0.000
The control group CFS Post-Pre test	15	-0.20	2.04	
The treatment group GHQ-12 Post-Pre test	15	-2.60	1.40	0.026
The control group GHQ-12 Post-Pre test	15	-0.33	3.48	

Table III showed mean value between post-test and pre-test was significantly difference in both therapy and control groups ($p < 0.05$). Cooper test results in the therapy group had 2.07 mean difference while the control group -0.21 ($p = 0.000$). Mean difference value of peak flow meter in therapy group resulted

at 25.33, meanwhile control group -11.33 ($p = 0.000$). Measurement of Chalder's Fatigue Scale (CFS) obtain 6.33 mean difference in therapy group, nevertheless in control group -0.20 ($p = 0.000$). Finally, GHQ-12 questionnaire resulted at -2.60 mean difference value in therapy group, while control group -0.33 ($p = 0.026$).

DISCUSSION

People need physical fitness badly to do daily activities in order to train self ability efficiently but create less fatigue (17). Beside that, physical fitness is also meant as one's capability which cover strength, endurance capability and ability also creative power to do certain job (18).

When a person does activities, it happens muscle contraction during activities than its contraction will send signal toward body's metabolism system to create more energy. Cardiovascular system also experiences changing performance to be more active in spreading the metabolism residue and binding more oxygen in blood, thus its breathing system will experience extra performance too (9).

Measuring cardio endurance using calculation of VO_2 maximum. VO_2 max or maximal oxygen absorption is an index of aerobic fitness or an indicator of cardio respiratory endurance (7).

In addition to VO_2 max calculation, the measurement of fatigue scale by using Chalders's fatigue scale questionnaire and General Health Questionnaire-12 (GHQ-12). Chalder's Fatigue Scale is a questionnaire used to measure physical and mental fatigue, while the General Health Questionnaire-12 (GHQ-12) is a questionnaire of life quality which consists of several questions to determine a person's mental state. A bad mental condition can affect a person's fatigue level in daily routines (6).

According to Traditional Chinese Medicine (TCM), pathogenesis of fatigue can be characterized by dysfunction of *Yin*, *Yang*, *Qi* and *Xue* (blood) in the *Zang Fu* organs, improper food consumption, and imbalance caused by over consumption of five tastes (sour, bitter, sweet, spicy, salty). Acupuncture therapy is worthwhile for coordinating and regulating yin and yang in order to stay healthy (19). In this study, acupuncture performs on Zusanli ST-36 and Sanyinjiao SP-6, because that point are frequently used for fatigue cases and has been proven by Evidence Based Medicine (EBM) to reduce fatigue (20).

The acupuncture mechanism that occurs in the therapy group with the Zusanli ST-36 and Sanyinjiao SP-6 points stimulating is the analgesic effect which can reduce pain influenced by the body's system in the form of releasing *endorphin*, *norepinephrin*, *serotonin*, atau *γ -amino butyric acid* (15). In this study, there is an increase in number of VO_2 max from the cooper test in the therapy group means that all respondents have better cardio respiratory endurance. With increased aerobic capacity (VO_2 max), the oxygen will be absorbed

more, so that it has an impact on increasing muscle performance during activity and reducing fatigue (21). The increase in oxygen absorption is influenced by the manipulation of *Sanyinjiao* SP-6 and *Zusanli* ST-36 point which can improve fitness. This acupuncture point application is in line with Imandiri's (2020) research which used this point to increase aerobic capacity (VO_2 max) value (9).

The result of *Peak Expiratory Flow Rate* (PEFR) in the therapy group get average increase over ten. The case shows that the ability of lungs function subjects is getting better. Stimulation of acupuncture point *Sanyinjiao* SP-6 is able to increase lungs function on respondents and *Zusanli* ST-36 can stimulate the production *nitric oxide* (NO) so the blood flow increases. According to Cooper in Basuki (2017) stated if someone does exercise periodically, he or she will have ability in absorbing the air and exhale the more remains of combustion in longer period because the muscles around has been exercised to do more activities (4). Based on the research done by Alimmattabrina (2015) the increase shows the capacity of consuming oxygen increases twice during exercise compared with the condition in the break time, moreover the increase of total lungs ventilation is around 20-22 times (22).

The research's subjects are fatigue (value range ≥ 7 up to ≤ 10) and mentally tired (value range ≤ 6). The subjects in therapy group get increasing to become untired with value score over 11 while the control group, some feel decrease, the fatigue value namely from untired category becomes fatigue. According to Alvita (2017), either mentally or physically fatigue can influence one's strength. The result of the research shows the average value GHQ-12 decreases in the group of therapy before and after acupuncture is done. This conditions happens because the stimulation of acupoint *Sanyinjiao* SP-6 can eliminate insomnia and anxiety. Enough rest (6 hours per day) not staying up late at night can normalize hormone performance inside the body so that body and *Qi* flow are in balance. When body is in balance condition thus it can manage moods and thoughts appearing the smoothness in *Qi* regulation on all organs too. This situation makes better mentally condition and life's quality too (5).

Based on Sheng Hsiung Hsiao's research, it can be concluded on acupoint *Zusanli* ST-36 can increase blood vessel by changing nitric oxide production (NO). It is known that *nitric oxide* (NO) is synthesis by 3 isoform *nitric oxide synthase* (NOS) one of them *endothelial nitric oxide synthase* (eNOS) which difuses into smooth muscle of blood vessels reacts with red cell of hemoglobin transfer oxygen and carbon dioxide. Acupuncture can stimulate the release of *nitric oxide* (NO) from endotel (23).

Acupuncture can not only increase mentally and physically body condition better but also decrease fatigue. Acupuncture stimulation on acupoint Zusanli ST-36 and Sanyinjiao SP-6 play the role in calming heart and strengthen spleen with 62.8% of success (24). In the other literature, if acupuncture is compared with conventional treatment in fatigue case, it will significantly decrease in the group of acupuncture (25). Research on conventional therapy which is done by Rui Chen concerned with immuno therapy in overcoming fatigue shows the therapy with IgG, 82% of research subjects got periodically side effects, namely the complainment in gastrointestinal, arthralgia, headache, worse fatigue. In addition of significant side effect such as cushing syndrome, boils, pimple, osteopenia, immunosuppression etc. often appear caused by high dose steroid therapy (26)

CONCLUSION

Acupuncture is effective in increasing cardiopulmonary endurance, decreasing fatigue levels and improving quality of life.

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