Comparison Effects of Tai Chi Chuan and Wai Tan Kung Exercises on VO2 max and Lipid Profile in Elderly

Romy Deviandri[1,2*], Purba A[2], Tarigan B[2]

[1]*Department of Physiology, Riau University, Riau, Indonesia*

[2]*Department of Medicine, Padjadjaran University, Indonesia*

Corresponding Author*

Romy Deviandri

Department of Physiology,

Riau University,

Riau, Indonesia

E-mail: romydeviandri@lecturer.unri.ac.id

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Abstract

Tai Chi Chuan and Wai Tan Kung exercises are popular and have been widely used especially in the elderly. Tai Chi and Wai Tan Kung is low impact activity in mild until moderate intensity. Possible gymnastics Tai Chi and Wai Tan Kung can affect the improvement of VO2 max and blood lipid profile. The cross sectional study was conducted. Subjects in this study were elderly members of the Tai Chi Chuan (20), Wai Tan Kung, (20) and sedentary people (20) as control group. The VO2 max and blood lipid profile (Total triglycerides, total cholesterol, LDL, HDL) was measured. The results, Tai Chi exercise improved VO2 max, blood total cholesterol and LDL level. There are no significant difference of blood total triglycerides and HDL level between Tai Chi, Wai Tan Kung and elderly sedenter.

Keywords: Tai Chi Chuan • Wai Tan Kung • VO2 max • Lipid profile • Cholesterol

Introduction

Increasing of elderly population is one indicator of successful development in the health sector. But on the other hand, this causes other health problems. Common health problems in the elderly are cardiovascular problems, falls, fractures, joint and arthritis diseases, diabetes mellitus, and also malnutrition. In elderly, decreasing of physical activity will affect in the cardiovascular endurance (VO2 max) and composition of body fat [1,2]. This will lead to weight gain and affect in the blood lipid profile too. Border lipid profile can lead to atherosclerosis that underlies the risk of narrowing of blood vessels and coronary heart disease. More than 15 million people die each year from heart disease, of which 7.2 million are obtained due to coronary heart disease. Various attempts were made to prevent the process of accelerating disease transfer in the elderly, including through sports. At present, many alternative sports are offered for the elderly, such as Tai Chi and Wai Tan Kung gymnastics.

Tai Chi Chuan has been practiced for centuries by millions of people in China [3]. Tai Chi consists of a series of postures that combine slow, gentle, and beautiful movements so that many attract the attention of the public [4]. The Wai Tan Kung is a type of traditional physical exercise originating from Taiwan. Wai Tan Kung is a unique exercise because it uses vibration and coordination of movements from the whole body, consisting of a few simple movements accompanied by breathing arrangements [5]. In their home country, the use of Tai Chi and Wai Tan Kung has become widespread in the community because they believe those can maintain health and extend life [3,5]. Similarly in Indonesia, Tai Chi and Wai Tan Kung exercises are also quite popular and have been widely used especially in the elderly. Wai Tan Kung is categorized into aerobic exercise with a mild intensity and Tai Chi can be grouped into moderate intensity exercises [3-5]. Possible gymnastics Tai Chi and Wai Tan Kung can affect the improvement of VO2 max and blood lipid profile. This is related to the opinion of McMurdo that exercise of relatively mild to moderate intensity can increase fat metabolism and improve physical fitness [6]. There are differences in the form of movements and the amount of exercise which includes the frequency, intensity and duration of the exercises between the Tai Chi exercises and Wai Tan Kung. This is the possibility that gives rise to differences in VO2 max and blood lipid profile between participants in the Tai Chi gymnastics with Wai Tan Kung.

Materials and Methods

This research is cross sectional study. Subjects in this study were elderly members of the Tai Chi Gymnastics, Wai Tan Kung, and sedentary people as control group. Subjects were taken by total sampling, Criteria for inclusion of subjects in this study were: Subjects aged 60-75 years, have been practicing Tai Chi or Wai Tan Kung for more than one year, female, not having acute or chronic disease, healthy condition based on history taking and physical examination, not smoking and not drinking, not taking drugs that affect body fat levels/diet drugs and substances aphrodisiacs (coffee, concentrated tea and drugs), did not undertake strenuous physical activity within 24 hours before the study was conducted, willing to follow the study by signing informed consent. The exclusion criteria for the subjects in this study were that the subjects refused to cooperate or were sick so they could not come when collecting data.

VO2 max was measured by Astrand-Rhyming step test protocol, and the blood sample 3 mL in volume was collected to measure of LDL, HDL, total triglyceryde and total cholesterol, food intake for 24 hours was collected by food recall chart. Calculation of data analyzed by using SPSS 25.0 software, Ms. Excel and NATS 2.0 nutrition analysis program. The difference was measured by independent t-test method.

Results

Physiological characteristics of the Tai Chi gymnastics members, Wai Tan Kung and Sedenter elderly in the form of age, blood pressure systole (mmHg), diastole (mmHg), pulse, weight, height, body mass, body mass index, triceps muscle thickness and subscapula, body fat composition, as well as blood lipid profile, can be seen in Table 1.

Table 1. Characteristic of subject.

Variabel	Mean		
	Tai Chi	Wai Tan Kung	Sedentery
Age (year)	65.22 ± 3.6	67.89 ± 5.80	66.33 ± 2.92
Sistole (mmHg)	130 ± 13.2	150.00 ± 15.81	143.33 ± 29.58
Diastole (mmHg)	77.78 ± 8.3	91.11 ± 11.67	88.89 ± 16.16
Heart rate (times/ minute)	72.67 ± 6.3	85.56 ± 10.57	90.00 ± 13.22
Body weight (kg)	55.28 ± 9.9	56.11 ± 7.39	56.72 ± 12.68
Height (cm)	1.52 ± 0.1	1.47 ± 0.03	1.46 ± 0.08
BMI (BB/kg mm2)	24.01 ± 4.3	25.76 ± 2.85	26.49 ± 4.26
Thicks fold of fat (%)	17.41 ± 1.7	21.13 ± 2.02	21.15 ± 2.82
VO2 max	30.18 ± 2.44	27.94 ± 2.68	25.94 ± 0.82
Total cholesterol (mg/dL)	194.89 ± 20.9	238.78 ± 30.40	225.44 ± 17.77
Triglycerida (mg/dL)	139.33 ± 63.7	155.89 ± 50.68	155.67 ± 46.75
HDL (mg/dL)	47.22 ± 9.2	49.33 ± 4.85	48.33 ± 9.21
LDL (mg/dL)	123.33 ± 24.4	149.33 ± 27.82	144.44 ± 14.42

From the data in Table 1 it can be seen that the mean age of Tai Chi, Wai Tan Kung and control group were 65.22 ± 3.60, 67.89 ± 5.80, and 66.33 ± 2.92 respectively. The mean Body Mass Index (BW/kgm2) for elderly members of the Tai Chi gymnastics is within normal limits, whereas for gymnastics members Wai Tan Kung and Sedenter elderly are in obese status.

The VO2 max of Tai Chi members is higher than the Wai Tan Kung and elderly Sedenter with a significant difference (30.18 ± 2.44 vs. 27.94 ± 2.68 vs. 25.94 ± 0.82 ml/kgBB/minute respectively, $p<0.05$).

The Total cholesterol level of Tai Chi members is lower than the Wai Tan Kung and elderly Sedenter with a significant difference (194.89 vs. 238.78 vs. 225.44 respectively, $p<0.05$). The LDL level of Tai Chi members is lower than the Wai Tan Kung and elderly sedenter with a significant difference (123.33 vs. 149.33 vs. 144.44 respectively, $p<0.05$). The total triglycerides level of Tai Chi members is not significant difference with Wai Tan Kung and elderly sedenter (139.33 vs. 155.89 155.67 respectively). The HDL level of Tai Chi members is not significant difference with Wai Tan Kung and elderly sedenter (47.22 vs. 49.33 vs. 48.33 respectively). While between the Wai Tan Kung and elderly sedenter group, there are no significant differences in all value.

Discussion

The results showed that the VO2 max of both elderly Tai Chi and Wai Tan Kung participants was higher than the elderly sedenter. These can be explained by the effect of the exercise on the cardiovascular endurance improvement in body. Tai Chi gymnastics is aerobics with moderate intensity, while Wai Tan Kung is a aerobic exercise in mild intensity. Performing Tai Chi and Wai Tan Kung exercises regularly will result in increasing of both respiratory muscle strength and oxygen diffusion in lung capillary [7]. This is consistent with the statement of Brown et al. that Tai Chi exercise will improve minute ventilation, stroke volume dan cardiac output [7]. Powers revealed that training with mild and moderate intensity will further increase the oxidation of fatty acids as an energy source. Muscle uses energy from free fatty acids and triglycerides. The longer the muscle contraction, the lipolysis is more increased [8,9]. Besides the intensity of exercise, the duration of exercise also needs to be considered to improve the composition of body fat. It takes more than 30 minutes to reduce body fat each time because of the time when lipolysis occurs in adipose tissue [9]. Tai Chi exercises are carried out with duration of 1-1.5 hours so that lipolysis becomes more optimal. The process of lipolysis is also influenced by adrenaline which will stimulate lipase [10]. Adrenaline levels will peak at the 60th minute of a series of physical exercises carried out, so that exercise carried out for an hour or more will have a pretty good effect for improving body fat composition. The results of this study are also in accordance with the statement of Swift et al. which states that physical exercise can control body weight so that it can reduce obesity. Aerobic exercise in a long period of time can maintain body composition by reducing body fat, where in aerobic exercise, fat is the biggest energy source for supplying energy during exercise [11].

The amount of exercise done on the Tai Chi exercise which includes the frequency, intensity, and duration of the exercise is greater than the Wai Tan Kung gymnastics. Based on field observations, Tai Chi exercises are performed with an average duration of 1-1.5 hours with varying movements and frequencies 6 times in 1 week. Whereas the Wai Tan Kung gymnastics is done with an average duration of half an hour with movements that are less variable and with a frequency of 6 times in 1 week. Aerobic exercise with higher intensity and longer duration may increase fat-free mass and increase loss of fat mass and is associated with reductions in health risk [12].

Total cholesterol levels and LDL in Tai Chi participants were lower than those Wai Tan Kung and Sedenter's elderly with significant differences. This is caused by the effect of the Tai Chi exercise dose which is greater than the Wai Tan Kung exercise so that changes in blood cholesterol are more meaningful. Continuous aerobic exercise will reduce total cholesterol and LDL levels in the blood because physical exercise will modify the activity of intravascular enzymes and transfer proteins that modify cholesterol such as Lecithin Cholesterol Acyltransferase (LCATa). Increased LCATa activity will reduce the production of cholesterol in the body [13]. In addition to exercise factors, total cholesterol and LDL are also influenced by dietary factors where a saturated fat diet will increase plasma cholesterol by 15%-25%, while a diet of unsaturated fats can reduce plasma cholesterol levels.

The results showed that there were no significant differences in triglyceride levels among elderly Tai Chi gymnastic participants compared with Wai Tan Kung (139.33 mg/dL vs. 155.89 mg/dL). This shows as if there is no effect of exercise on triglyceride levels. But clinically, there were actually significant differences in triglyceride levels in each group. Triglyceride levels in elderly Tai Chi exercise participants are within normal limits (139.33 mg/dL) so that improvement in triglyceride levels is more optimize, while triglyceride levels in the Wai Tan Kung group and Sedenter elderly are in the slightly high limit (155.89 mg/dL and 155.67 mg/dL). This is supported by Grandjean et al. said that in subjects with low triglyceride levels, the triglyceride levels will not change after exercise. Differences in triglycerides in each group due to the effect of continuous aerobic exercise on the decrease in triglycerides in the blood [13].

The results showed that there were no significant differences in HDL levels among elderly Tai Chi, Wai Tan Kung and Sedenter group. These results show as if there is no effect of exercise there is improvement in blood HDL. But clinically, the actual HDL levels in each group are within normal limits so that the effect of exercise is more optimized for blood HDL levels.

The results of this study support research conducted by Grandjean, Crouse and Rohack that aerobic exercise can reduce levels of total cholesterol, triglycerides and LDL, and increase HDL levels in the blood [13,14].

Conclusion

The influence is closely related to catecholamines and the increase in the work of enzymes that affect lipolysis, especially the work of hormone-sensitive lipase enzymes. During exercise, there will be an increase in blood levels of catecholamines. Catecholamines will increase the action of hormone sensitive lipases which will increase the hydrolysis of triglycerides. Physical exercise will affect the blood lipid profile by modifying intravascular enzyme activity and protein transfer. After aerobic exercise, there is an increase in the activity of Lipoprotein Lipase (LPLa) and lecithin cholesterol acyltransferase (LCATa). There is also a decrease in triglyceride lipase (HTGLa) activity in the liver and Cholesterol Ester Transfer Protein (CETP). Increasing LPLa and LCATa will reduce triglyceride levels and increase HDL-C. At the same time, decreasing (HTGLa) and (CETP) will slow down HDL catabolism thereby increasing HDL in the blood. However, the difference in lipid profile is not only caused by exercise factors because there are still many other factors that can affect blood lipid profile including lipid profile before exercise, diet, weight loss, body fat composition, volume and intensity of exercise and genetic.

Conflict of Interest

All author declared that there is no conflict of interest in this paper.

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