Effects of 12 Weeks Aerobic Exercise by Applied Sakon Nakhon Traditional Thai Boxing Dance Exercise Program on Insulin Resistance and Lipid Profiles in Thai Elderly Females

ผลของการฝึกออกกำลังกายด้วยโปรแกรมมวยไทยโบราณสกลนครประยุกต์ ใน 12 สัปดาห์ต่อระดับความดื้อต่อ อินซูลินและไขมันในเลือด ในหญิงไทยวัยสูงอายุ

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ABSTRACT

Older people showed risk of various chronic diseases, such as diabetes mellitus, hypertension, atherosclerosis and stroke. However, it was believed that aerobic exercise might be improved those. So the objective of this study was to investigate insulin resistance and lipid profiles after 12 weeks of applied Sakon Nakhon Traditional Thai Boxing dance (SNTB) exercise training in Thai elderly female aged between 61-70 years old. All of volunteer subjects had body mass index (BMI) 23.0-29.9 kg/m^2 with good health, no chronic disease, no infection, and agreed to sign in consent form. They were divided into 2 groups; control group (n=15) and applied SNTB-exercise group (n=15). In control subjects behaved as their normal lifestyles while applied SNTB-exercise subjects were assigned applied SNTB aerobic exercise 30 min/session (5 min warm up, 20 min exercise of 60-75% HRmax and 5 min cool down) 3 days/week in 12 consecutive weeks. Results of fasting blood sugar (FBS), Insulin, HOMA-IR and lipid profiles such as high density lipoprotein-cholesterol (HDL-C), Low density lipoprotein-cholesterol (LDL-C), cholesterol (C) and triglyceride (TG) were assessed, In elderly control group, insulin, HOMA-IR and lipid profiles showed no significant difference. While FBS showed increase in high significant difference ($p<0.01$). In regard to elderly exercise groups, insulin and HOMA-IR showed decrease in highly significant difference ($p<0.001$). FBS showed decrease high significant difference ($p<0.01$). Cholesterol and triglyceride decreased significant difference ($p<0.05$). while HDL-C and LDL-C showed no significant difference. In conclusion, effect of 12 weeks aerobic exercise by SNTB exercise training could improve insulin resistance and decrease cholesterol and triglycerides that were risk of chronic diseases including diabetes mellitus, atherosclensis, hypertension and stroke. Therefore, Applied SNTB exercise program was useful as health promotion exercise program in Thai elderly female.

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บทคัดย่อ

วัยสูงอายุเป็นวัยที่เสี่ยงต่อการเกิดโรคเรื้อรังในหลาย ๆโรคเช่น เบาหวาน ความดันโลหิตสูง หลอดเลือดแดงแข็งตัวโรคหลอดเลือดสมอง วัตถุประสงค์ของการศึกษาเพื่อศึกษา ผลของการฝึกออกกำลังกายด้วยโปรแกรมมวยไทยโบราณสกลนครประยุกต์ใน 12 สัปดาห์ต่อระดับความดื้อต่ออินซูลินและไขมันในเลือดในหญิงไทยวัยสูงอายุ อายุระหว่าง 6170- ปี มีค่าดัชนีมวลกาย 23.029.9- กก./ตรม. จำนวน 30 คน สุขภาพทั่วไปแข็งแรงสมบูรณ์ไม่มีโรคติดต่อหรือโรคเรื้อรังร้ายแรงใด ๆ เป็นอาสาสมัครที่ถูกคัดเลือกเข้าทำการศึกษาวิจัยในครั้งนี้โดยแบ่งเป็น 2 กลุ่ม กลุ่มควบคุม (n=15)ให้ดำเนินชีวิตด้วยความปกติ ส่วนกลุ่มออกกำลังกาย (n=15) จะได้รับการฝึกด้วยท่ารำมวยไทยโบราณสกลนครประยุกต์ ผลการศึกษาพบว่ากลุ่มควบคุมค่า อินซูลิน HOMA-IR และค่าไขมันในเลือดไม่มีการเปลี่ยนแปลงพบเพียงค่า ระดับน้ำตาลในเลือดที่มีการเปลี่ยนแปลงเพิ่มขึ้นอย่างมีนัยสำคัญทางสถิติที่ ($p<0.01$) ส่วนในกลุ่มทดลองค่า อินซูลิน และ HOMA-IR มีการเปลี่ยนแปลงลดลงอย่างมีนัยสำคัญทางสถิติที่ ($p<0.001$) ค่าระดับน้ำตาลในเลือดเปลี่ยนแปลงลดลงอย่างมีนัยสำคัญทางสถิติที่ ($p<0.01$) และค่า คลอเรสเตอรอลและไตรกลีเซอไรด์ เปลี่ยนแปลงลดลงอย่างมีนัยสำคัญทางสถิติที่ ($p<0.05$) ในขณะที่ค่า ไขมันในเลือดชนิดดี และค่าไขมันชนิดเลว ไม่มีการเปลี่ยนแปลงสรุป ผลของการฝึกการออกกำลังกายแบบแอโรบิกด้วยโปรแกรมมวยไทยโบราณสกลนครประยุกต์สามารถลดระดับความดื้อต่ออินซูลิน คลอเรสเตอรอลและไตรกลีเซอไรด์ซึ่งเสียงต่อโรคเรื้อรัง เบาหวาน ความดันโลหิตสูงและ หลอดเลือดแดงแข็งตัว ดังนั้นโปรแกรมมวยไทยโบราณสกลนครประยุกต์เป็นโปรแกรมที่ช่วยในการส่งเสริมสุขภาพในหญิงไทยวัยสูงอายุได้

Keywords: Sakon Nakhon Tradition Thai Boxing dance (SNTB), Insulin resistance, Lipid profile, Aerobic exercise, Elderly

คำสำคัญ : การออกกำลังกายด้วยท่ารำมวยไทยโบราณสกลนครประยุกต์ ระดับความดื้อต่ออินซูลิน ไขมันในเลือด การออกกำลังกายแบบแอโรบิก วัยสูงอายุ

Introduction

In almost every country, the proportion of people aged over 60 years is growing faster than any other age group, as a result of both longer life expectancy and declining fertility rates. In the next 20 years, the number of people over 60 years of age will double [1], raising the issue of finding feasible means for their independent living [2]. In fact, the aging populations are those who are in need of specific encouragement to engage in physical activity [3]. Exercise and physical activity have been suggested as effective means to maintain independent living in old age [5-4]. Diseases are a concern for the aging population as the recovery is longer, and most of the time incomplete, often leading to hospitalization, complication, integration in specialized care centers and ultimately death .Older people is often associated with a deterioration in glucose tolerance [6] as a result of development of insulin resistance and abnormal function of the pancreatic betacell [7]. Even in those older people whose glucose tolerance is normal by National Diabetes Data Group (NDDG) standards [8], blood glucose and insulin levels tend to be higher than those of young people following an oral glucose challenge [9-11].

The factors that disturb lipid metabolism; hence put elderly subjects at risk of developing cerebrovascular and/or coronary heart diseases. Actually, previous

reports proposed that human with exceptional longevity have significantly larger high density lipoprotein (HDL) and low density lipoproteins (LDL) particle sizes [12-13]. Previous data reported the effect of age and gender in serum lipids levels gave mixed results. There were repeated evidences that LDL-cholesterol tend to rise with age in both sexes [14-15]. Conversely, considerable studies prove significantly negative correlation between total and/or LDL cholesterol and age [16-17].

Exercise is a readily available intervention that can increase insulin action [18-23] and prevent the onset of diabetes [24-27]. An important question is whether the effects of aerobic exercise on insulin action are diminished with advancing age. A recent study reported that a vigorous 7-day exercise program increased insulin sensitivity and muscle glucose transporter (GLUT4) content by a similar amount in younger (22 years) and older (61 years) people [28]. However, current health and fitness guidelines for healthy adults recommend exercising at more moderate intensities at least 3 days per week over long periods [29].

Moreover, research indicates that strength training is necessary either to stop or reverse sarcopenia—the age-associated loss of body protein—and to increase bone density. As one grows older, an active lifestyle is more important especially exercise. Exercise can improve and maintain health-quality of life (HQL) and increasing the HQL is one of the primary goals for health improvement in older persons [30]. There are many kinds of exercise using for health promotion in elders such as walking, running, cycling, yoka and Thai boxing dance. In Thai Boxing, nowadays is used as a sport and exercise. Thai boxing or Muay Thai is a kind of folk cultural heritage from antiquity. However, it has many forms and many ways to perform tasks such as Muay Chaiya, Muay Korat, Muay Lopburi and Muay Thai Boran Sakon Nakhon. The last one type, Sakon Nakhon Traditional Thai Boxing is accepted as heritage boxing art of Thailand .The beginning of that Sakon Nakhon Tradtional Thai boxing is established at Sakon Nakhon province which is one of an ancient province in Northestern part of Thailand. Clay Ornament of Sakon Nakhon province is the first person to collect and convey the ancient art of boxing Sakon and has been regarded as an outstanding cultural, sports and recreation branch of the Office of the National Culture in the year 1986. However, exercise in elderly people are fragile and not stronger enough to use strengthen Thai boxing. Therefore, this study tries to modify applied SNTB exercise as new exercise program for those people in purpose of health promotion and improvement quality of life. This study investigated insulin resistance including FBS and lipid profile after 12 weeks of applied Sakon Nakhon Traditional Thai Boxing dance exercise.

Objective of this study

The objective of this study was to investigate insulin resistance and lipid profiles after 12 weeks of applied Sakon Nakhon Traditional Thai Boxing dance exercise in Thai elderly females.

Materials and Methods

Study design and population

This study was a quasi-experiment in humans and conducted by evaluating clinical baseline characteristics, anthropometry, and blood chemistry in elderly female Thais. Thirty elderly subjects, were assigned into control group and exercise group by random sampling. All subjects completed a confidential

health-screening questionnaire by a physician. Subjects had no history of chronic illness such as cardiovascular diseases, coronary heart disease, arrhythmia, chronic heart failure, hypertension, stoke, arthritis, neuromuscular disorders, pulmonary diseases, diabetes mellitus and other diseases. Subjects were asked to assess physical examination on physical performance, anthropometry, and blood chemistry of insulin resistance and lipid profiles at Vejvichakarn Building and Srinakarind Hospital, Faculty of Medicine, Khon Kaen University, Thailand. Number of participant in this study calculated sample size formula.

Study protocol

Thai elderly female, subjects aged between 61 to 70 years. BMI 23.00-29.9 kg/m^2, participated voluntary in this study. They were divided into 2 groups; control group and applied SNTB exercise group. Elderly control group (n=15) behaved as normal lifestyles with no aerobic exercise program and elderly exercise group (n=15) were assigned to practice aerobic exercise of applied Sakon Nakhon traditional Thai boxing 30 min/session (5 min warm-up, 20 min exercise of 60 to 75% HR max, 5 min cool-down), 3 days/week, in 12 consecutive weeks. All subjects also behaved as normal lifestyles in eating behaviors. Characteristics insulin resistance and lipid profiles were measured before and after 12 weeks of aerobic exercise program.

Ethical approval

A written informed consent from the participants was obtained before testing .The methods of this study has been reviewed and approved by the Khon Kaen University Ethics Committee for Human Research). HE 561426

Statistical Analyses

Data were expressed as mean ± SD. The STATA 12 Statistical software was used to perform the statistical analysis. Unpaired t-test was used to compare differences in characteristics of all parameters between control group and exercise groups in elderly. Two-sample Wilcoxon rank-sum (Mann -Whitney) test was used when data deviated from normality, p value less than 0.05 was considered to be statistically significant.

Results

Baseline Characteristics of Subjects

Baseline clinical characteristics, vital signs and anthropometry of elderly subjects in control group (n=15) and exercise group (n=15) were shown in Tables 1. Data of baseline characteristics showed no significant differences at pre-exercise (week 0) in all parameters.

Blood Chemistry

In elderly control group, Data of insulin, HOMA-IR and lipid profiles showed no significant difference, while FBS shown increased high significant different ($p<0.01$). In regard to elderly exercise group, insulin and HOMA-IR showed decreased highly significant difference ($p<0.01$). FBS showed decrease high significantly difference ($p<0.01$). Cholesterol and triglyceride decreased significant difference ($p<0.05$). Consequenty, while, HDL-C and LDL-C showed no significant difference (Fig. 1).

Discussion

SNTB exercise on blood chemistry

The result of this study in elderly exercise group HDL-c increased significant difference, including FBS, HOMA-IR decreased high significant difference and insulin decreased highly significant difference. Similarly, mechanism may be working in our subjects as a systematic review also found the effects of yoga training to be more prominent with regard to fasting blood glucose level and lipid profile [31]. Innes and Vincent [32] reviewed 12 studies and reported that yoga improves lipid profile. Reductions in TC, TG, and LDL and increase in HDL in our subjects are comparable with the findings of their review. The decrease in lipid profile seen in this study is in agreement with the earlier studies. Sahay [33]and Bijlani et al [34] reported a significant reduction in free fatty acids, LDL and an increase in HDL. The improvement in the lipid profile after yoga could due to increased hepatic lipase and lipoprotein lipase at cellular level, which affects the metabolism of lipoprotein and thus increase uptake of triglycerides by adipose tissues [35-36]. These changes suggest improvement in the insulin sensitivity following yogic exercises.

Exercise is a major therapeutic modality in the treatment of diabetes mellitus [37]. Exercise training has been known to be effective in type 2 diabetes mellitus by increasing insulin sensitivity [38], and regular exercise can strengthen antioxidant defenses and may reduce oxidative stress [39]. Exercises including yoga postures have been

Some evidences have pointed that endurance exercise training can increase plasma HDL levels if the exercise training is sufficient [41-40] Thus, not only endurance exercise, but also low-velocity and low-impact exercise such as SNTB can increase the serum HDL-C in it practitioners .The mechanism underlying the increase in HDL-C after endurance exercise or 12 weeks of SNTB is not clear yet.

In addition, previous study suggested that long-term higher intensity exercise training provides more enduring benefits to insulin action compared with moderate- or low-intensity exercise, likely due to greater transient effects [42]. Stefanyk and Dyck suggested that glucose transport is stimulated by both insulin and insulin-independent mechanisms. The insulin-stimulated glucose uptake is found in skeletal muscle by increasing the regulation of GLUT4 expression and promoting the insulin signal transduction to glucose homeostasis. Insulin promotes glucose uptake through motivation of phosphoinositide 3 (PI3)-kinase, protein kinase B (Akt), and some protein kinase C [43].

Indeed, exercise is a tool to help older adults to overcome their disabilities and improve all aspects of health-quality of life particularly to maintain their health conditions and perform activities of daily living .Meta-analytic reviews have proven that exercise is associated with a variety of health improvements such as decreased risk of coronary heart disease and stroke[45-44] improved cognition in sedentary older adults [38], a modest benefit in health-quality of life for frail or older adults [46], and a positive association with successful aging [47].

This study investigated in females elderly Thais aged between 61 to 70 years old whether aerobic exercise training by SNTB improve insulin resistance and lipid profiles. Moreover, the number of exercise subjects increase and it should be trained in male Thai subjects, too.

Conclusions

After 12 weeks of SNTB exercise training, Thai elderly females, age 61-70 years old decrease in insulin resistance, cholesterol and triglycerides. Those are risk factors of atherosclerosis, diabetes mellitus, hypertension and stroke. Therefore, SNTB exercise program is a method to useful in health promotion of Thai elderly females.

Future Study

SNTB exercise training may be used as a model exercise in diabetic, hypertension and metabolic syndrome subjects. And it also used in menopause or pre-elderly subjects age 50-60 years old for further study.

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Table 1 Baseline clinical characteristics, vital signs and anthropometry of elderly subjects in control group (n=15) and exercise group (n=15) at pre-exercise (week 0).

Variables	Elderly group (n=30)			
	Control (n=15)	Exercise (n=15)	% Mean Difference	P-Value
	$\overline{X}$ ± SD	$\overline{X}$ ± SD		
Age (years)	64 ± 3.35	64 ± 3.46	0	0.660 NS
BW (kg)	56.59 ± 7.74	56.54 ± 9.52	0.44	0.490 NS
Height (cm)	149.00 ± 5.88	150.71 ± 4.58	0.67	0.690 NS
BMI (kg/ m^2)	25.11 ± 3.58	24.81 ± 3.35	1.19	0.470 NS
Total body fat (%)	36.25 ± 5.88	37.04 ± 5.66	2.18	0.770 NS
Total body water (%)	52.62 ± 6.08	50.24 ± 7.84	12.21	0.430 NS
WC (cm)	86.27 ± 10.17	87.72 ± 8.36	2.34	0.410 NS
HC (cm)	100.33 ±11.76	95.28 ±10.98	4.69	0.060 NS
WHR	0.84 ± 0.07	0.88 ± 0.11	4.76	0.180 NS
SBP (mmHg)	123 ± 7.8	129 ± 12.9	4.30	0.130 NS
DBP (mmHg	74 ± 10.1	76 ± 10.57	2.58	0.540 NS
MAP (mmHg)	90 ±7.40	93 ±9.35	3.35	0.310 NS
HR (beats/min)	77 ± 9.9	70 ± 8.62	9.17	0.060 NS

BW, Body weight; BMI, Body mass index; WC, Waist circumference; HC, Hip circumference; WHR, Waist to hip ratio; SBP, Systolic blood pressure; DBP, Diastolic blood pressure; MAP, Mean arterial pressure; HR, Heart rate. Data are presented as mean ($\overline{X}$) ± SD and tested by unpaired t-test, significant difference in control versus exercise group; NS, No significant difference.

Table 2 Blood chemistry of elderly subjects (n=30) in control group (n=15) and exercise group (n=15) at pre-exercise (week 0) and at post-exercise (week 12).

	Elderly group (n=30)							
	Control (n=15)				Exercise (n=15)			
	pre-test week.0	post-test week.12	%Mean Difference	P-Value	pre-test week.0	post-test week.12	%Mean Differene	P-Value
FBS (mg/dL)	93.0±13.8	110.5±37	18.81	0.005**	95.2 ± 12.4	89.5 ± 9.1	5.98	0.005**
Insulin (uIU/ml)	11.5 ± 4.5	11.7±10.2	1.73	0.934 NS	9.0 ± 2.8	5.3 ± 3.7	41.11	0.000***
HOMA-IR	2.6 ± 1.2	3.5 ± 3.6	34.6	0.570 NS	2.1± 0.7	1.1 ± 0.9	47.61	0.000**
Cholesterol(mg/dL)	214.73±217	213.4 ± 19.62	0.61	0.744 NS	226.8± 41.39	216.2 ± 23.49	4.67	0.217 NS
Triglyceride (mg/dL)	133.8 ±62.3	141.0 ± 59.3	5.38	0.146 NS	227±148.00	196.4±86.16	13.48	0.277 NS
HDL-C (mg/dL)	48.5 ± 9.2	51.2 ± 10.6	5.56	0.056 NS	47.0 ± 10.1	51.5± 9.3	9.57	0.029*
LDL-C (mg/dL)	128.5 ±24.0	130.1 ± 28.3	1.24	0.815 NS	146.3 ± 40.7	139.8 ± 34.7	4.44	0.333 NS

Data are presented as mean ($\overline{X}$) ± SD and tested by unpaired t-test, *p<0.05 significant difference **p<0.01 significant difference ***p<0.001 significant difference in control versus exercise group; NS, No significant difference.

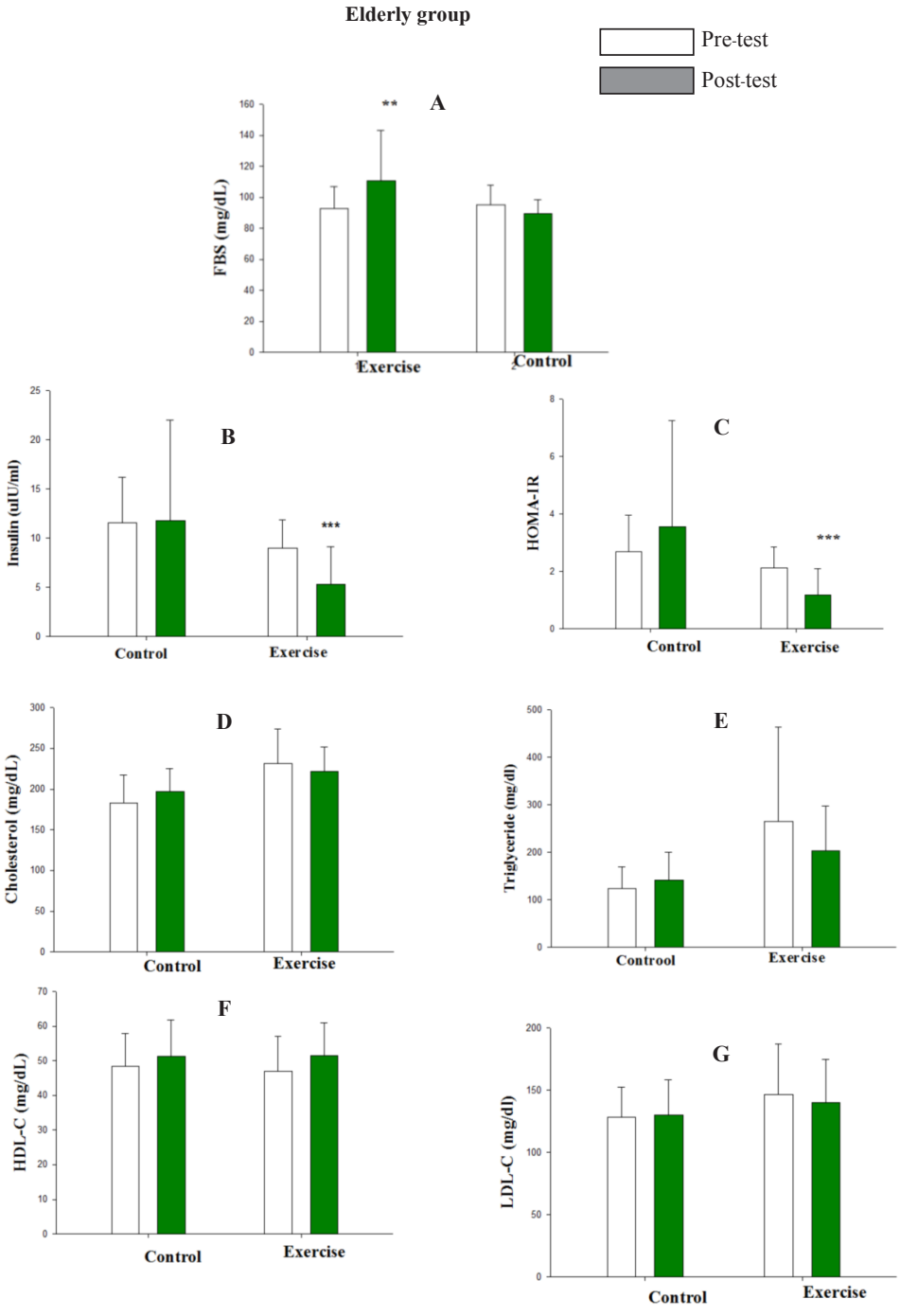

Figure 1 The measurements of (A) FBS, (B) Insulin, (C) HOMA-IR (D) Cholesterol, (E) Triglyceride, (F) HDL-C, (G) LDL-C during pre-test and post-test after 12 weeks of SNTB exercise in elderly group (control, n = 15; exercise, n= 15) Data present as mean ($\overline{X}$) ± SD and test by paired t-test ** $p<0.01$ High significant difference and *** $p<0.001$ Highly significant difference in pre-versus post- test by paired t-test.