A New Exercise Model: Brisk Walking with Swaying Hips and Hand Weight Load Exercise Program and Its Effect on Anthropometry, Physical Performance and Cardiopulmonary Function in Obese Thai Adults

การออกกำลังกายรูปแบบใหม่ด้วยการเดินเร็วและบิดเอว ร่วมกับการเพิ่มน้ำหนักที่แขนต่อสมรรถภาพกายและหน้าที่การทำงานของหัวใจและปอดในคนไทยวัยผู้ใหญ่ที่มีภาวะโรคอ้วน

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ABSTRACT

Obesity is an important risk factor for several diseases. The objective of this study was to investigate anthropometry, physical performance and cardiopulmonary function after 12 weeks of brisk walking with swaying hips and hand weight load (BWSH) exercise model in obese Thai adults, aged between 20 to 35 years. Thirty-two obese, BMI 30.0-40.0 kg/m^2 were divided into 2 groups; control obese group (CObs; n=15) subjects behave a normal lifestyle and exercise obese group (ExOb; n=17) BWSH hand weight load of 0.9 - 2.26 kg at both hands performed for 40 min/session (5 min warm up, 30 min exercise of 60 to 80% HR max and 5 min cool down) at least 3 days/week for 12 consecutive weeks. Results of body weight (BW), body mass index (BMI), waist circumference (WC), waist to hip ratio (WHR), blood pressure (BP) and heart rate (HR) showed no significant differences in both groups, while hip circumference (HC) was decreased significantly ($p<0.05$) at weeks 8 and 12. Percentage of total body fat was decreased at weeks 4, 8 and 12 of exercise group ($p<0.001$). Besides, hand grips and leg strength test was increased at weeks 4 and 8 ($p<0.05$) and in week 12 ($p<0.01$), respectively. Back strength test showed only increase at weeks 8 and 12 ($p<0.05$) compared to control obese group. The results of cardiopulmonary function test by six-minute walk test (6MWT) showed increase ($p<0.01$) at week 4 from 560.59 ± 52.02 m to 589.53 ± 58.13 m and

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increased ($p<0.001$) at weeks 8 and 12 from 560.59 ± 52.02 m to 620.18 ± 56.87 m and 560.59 ± 52.02 m to 635 ± 64.57 m in obese exercise group, respectively. This study shows that aerobic exercise, BWSH, is a new exercise model to be suitable for health promotion on anthropometry, physical performance and cardiopulmonary function in obese Thai adults.

บทคัดย่อ

โรคอ้วนเป็นปัจจัยเสี่ยงที่สำคัญสำหรับหลายๆ โรค วัตถุประสงค์ของการศึกษาเพื่อศึกษาผลของการวัดสัดส่วนของร่างกาย สมรรถภาพกายและหน้าที่การทำงานของหัวใจและปอดหลังจาก 12 สัปดาห์ของการฝึกออกกำลังกายด้วยการเดินเร็วและบิดเอวร่วมกับการเพิ่มน้ำหนักที่แขน (BWSH) ในคนไทยวัยผู้ใหญ่ที่มีภาวะโรคอ้วนมีอายุระหว่าง 20-35 ปี อาสาสมัครโรคอ้วนจำนวน 32 ราย ดัชนีมวลกาย 30.0-40.0 กก. / ตร.ม. ถูกแบ่งออกเป็น 2 กลุ่ม กลุ่มโรคอ้วนควบคุม (COb; n=15) และกลุ่มโรคอ้วนออกกำลังกาย (ExOb; n=17) กลุ่มควบคุมให้ดำเนินชีวิตตามปกติ ส่วนกลุ่มออกกำลังกายจะได้รับการฝึกเดินเร็วและบิดเอวร่วมกับการเพิ่มน้ำหนักที่แขน 0.9-2.26 กิโลกรัม โดยให้ออกกำลังกาย 40 นาที/ครั้ง (5 นาที อบอุ่นร่างกาย 30 นาที ออกกำลังกายที่ความหนัก 60-80% ของอัตราการเต้นหัวใจสูงสุด (HRmax) และ 5 นาทีคลายอุ่น) อย่างน้อย 3 วันต่อสัปดาห์จนครบ 12 สัปดาห์ติดต่อกัน ผลของน้ำหนักตัว (BW) ดัชนีมวลกาย (BMI) เส้นรอบเอว (WC) อัตราส่วนรอบเอวต่อรอบสะโพก (WHR) ตลอดจนความดันเลือด (BP) และอัตราการเต้นหัวใจ (HR) พบว่าไม่แตกต่างกันอย่างมีนัยสำคัญทางสถิติในทั้งสองกลุ่ม ผลเฉพาะเส้นรอบสะโพก (HC) เท่านั้นที่แสดงให้เห็นความแตกต่างลดลงอย่างมีนัยสำคัญทางสถิติ ($p<0.05$) ในสัปดาห์ที่ 8 และ 12 ขณะที่ร้อยละของไขมันในร่างกายทั้งหมดแสดงผลลดลงในสัปดาห์ที่ 4 8 และ 12 ที่ $p<0.001$ ของกลุ่มออกกำลังกาย นอกจากนี้ผลของความแข็งแรงของมือและของขาเพิ่มขึ้น ในสัปดาห์ที่ 4 8 และ 12 ที่ $p<0.01$ ตามลำดับ ขณะที่ความแข็งแรงของหลังเพิ่มขึ้น ($p<0.05$) เฉพาะในสัปดาห์ที่ 8 และ 12 เมื่อเปรียบเทียบกับกลุ่มโรคอ้วนควบคุม ผลการทดสอบหน้าที่การทำงานของหัวใจและปอดโดยการทดสอบเดินเร็วหกนาที (6MWT) แสดงให้เห็นว่ามีการเพิ่มขึ้นของระยะทางอย่างมีนัยสำคัญทางสถิติ ที่ $p<0.01$ ในสัปดาห์ที่ 4 จาก 560.59 ± 52.02 เมตร เป็น 589.53 ± 58.13 เมตรและที่ $p<0.001$ ใน สัปดาห์ที่ 8 และ 12 จาก 560.59 ± 52.02 เมตร เป็น 620.18 ± 56.87 เมตร และ 560.59 ± 52.02 เมตร เป็น 635 ± 64.57 เมตร ตามลำดับ การศึกษาครั้งนี้แสดงให้เห็นว่าการออกกำลังกายแอโรบิกด้วยการเดินเร็วและบิดเอวร่วมกับการเพิ่มน้ำหนักที่แขนเป็นรูปแบบใหม่ของการออกกำลังกายที่เหมาะสำหรับสร้างเสริมสุขภาพและช่วยเพิ่มการวัดสัดส่วนของร่างกาย สมรรถภาพกายและหน้าที่การทำงานของหัวใจและปอดในคนไทยวัยผู้ใหญ่ที่มีภาวะโรคอ้วน

Keywords: Brisk Walking with Swaying Hips and Hand Weight (BWSH), Physical performance, Cardiopulmonary function

คำสำคัญ: การออกกำลังกายด้วยการเดินเร็วและบิดเอวร่วมกับการเพิ่มน้ำหนักที่แขน สมรรถภาพกาย หน้าที่การทำงานของหัวใจและปอด

Introduction

Obese or obesity is a medical condition in which excess body fat has accumulated to the extent that it may have an adverse effect on health, leading to reduction of life expectancy and/or increase of health problems. People are considered obese when their body mass index (BMI) exceeds 30 kg/m^2 [1]. Obesity is related to risk increasing in chronic non-communicable disease (NCD) such as cardiovascular disease, type 2 diabetes mellitus, hypertension, dyslipidemia, cancer and osteoarthritis, including lower quality of life and premature mortality [2]. Obesity developed because of an imbalance between energy intake and energy expenditure that are affected by genetic and environmental factors such as sedentary lifestyle, high calorie foods and fast food [3]. The prevalence of Thais involving in little exercise or physical activity or having sedentary lifestyles is high, e.g. 67% or 6 million in 2007 [4]. In Thailand, the prevalence of obesity increased by around 19% from 1997 to 2004 [5]. In the age of 25 to 35 years, those people are man power of their country. Nowadays, those are changes of lifestyle to high technology and sitting on desk with their computer, less exercise. Most Thai people, especially those who aged between 25-35 years, are likely to spend their time on a computer or television.

Regular physical activity or aerobic exercise is known to provide health and fitness benefits, muscular strength, cardio-respiratory and muscular endurance, flexibility, reduced body fat, physical function, and decreased depression and anxiety. It can also decrease the risk of chronic conditions such as coronary heart disease, diabetes, obesity, hypertension, stroke, colorectal cancer, breast cancer, and osteoporosis [6]. Generally, light-to-moderate intensity activities that are sufficiently supported by aerobic metabolism can be performed for extended periods of time [7]. The intensity should be between 60 and 85% of maximum heart rate [8].

Hand weight load is a kind of resistant training. Resistant training, e.g. weight lifting including strength, endurance, and power can improve all components of muscular fitness [9]. In fact, muscular strength and endurance are important components of being healthy. Studies revealed exercise to improve muscle strength is critical to health and well-being [10-11]

Basically, there are many types of aerobic endurance exercise, for example, swimming, cycling, jogging, running, climbing and brisk walking. A 12-week exercise program of brisk marching improved respiratory muscle strength, pulmonary function, physical performance and cardiovascular endurance and modification of cardiac autonomic control among sedentary Thais [12]. Six-minute walk test (6MWT) is used for indirect measurement of cardiopulmonary endurance function. 6MWT has been used as a performance-based measurement of functional exercise capacity in other populations including healthy adults and patients [13]. The 6MWT represents

a practical and reliable assessment tool for exercise performance in overweight children and adolescents [14].

Walking is the most popular form of exercise for all age groups. Brisk walking can be done anywhere and at anytime. Give at least 20-30 minutes to walking to derive maximum benefits from it. Can prevent diseases and improve cardiovascular or cardiopulmonary endurance, heart system and physical fitness [15]. Brisk walking exercise is often recommended because it is easy to practice without using the device properly for obese group. Besides, it has low impact on knees and ankles, especially for those who begin to exercise without using the device.

Brisk walking with swaying hips and hand weight load (BWSH) training is a mixed type of aerobic endurance exercise (brisk walking and swaying hips). Swaying hips exercise training program can improve abdominal muscle, decrease waist circumference, decrease fat deposit. Hand weight load exercise is some type of resistance training. It can increase resistance and use more energy expenditure of the upper body and increase muscle strength. However, there have been no studies on brisk walking with swaying hips and hand weight load (BWSH) before. Therefore, this is the first time to apply the action of BWSH as health promotion exercise program.

This study investigated anthropometry, physical performance and cardiopulmonary function in obese Thai adults after 12 weeks of brisk walking with swaying hips and hand weight load as a new exercise model for health promotion in obese Thai adults.

Objective of this Study

The objective of this study was to investigate anthropometry, physical performance and cardiopulmonary function test after 4, 8 and 12 weeks of BWSH exercise in obese Thai adults

Materials and Methods

Study design and population

This study was a quasi-experiment in humans and conducted by evaluating anthropometry, physical performance and cardiopulmonary function in obese Thai adults. Subjects, aged between 20 to 35 years, were recruited as volunteers, both male and female. Thirty-two obese subjects with BMI 30.0-40.0 kg/m2, were assigned into control group (Cob, n=15) or exercise group (ExOb, n=17) 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 (i.e., coronary heart disease, arrhythmia and chronic heart failure), arthritis, neuromuscular disorders, pulmonary diseases, diabetes mellitus and other diseases. They had pre-hypertension (BP 120-139 /80-89 mmHg) or hypertension stage I (BP 140-159/ 90-99 mmHg). All of them were non-smokers or alcoholic drinkers and accepted to sign in a consent form. Participants were asked to assess physical examination on anthropometry, physical performance and

cardiopulmonary function at Vejvichakarn Building, Faculty of Medicine, Khon Kaen University, Thailand.

Study Protocol

Control obese subjects had normal lifestyles, while exercise obese subjects were trained with BWSH 40 min/session (5 min warm-up, 30 min exercise of 60 to 80% HR max and 5 min cool-down) at least 3 days/week in 12 consecutive weeks. Anthropometry, muscle strength, and six-minute walk test (6MWT) at pre-exercise (week 0), during exercise (weeks 4 and 8) and post-exercise (week 12) were assessed in both groups.

Ethical Approval

A written informed consent was obtained before testing. The methods of this study have been reviewed and approved by the Khon Kaen University Ethics Committee for Human Research (HE561482).

Statistical Analyses

Data were expressed as mean ± SD. The STATA 12 Statistical software was used to perform the statistical analysis. A paired t-test was used to compare differences in characteristics at all parameters between control obese and exercise obese groups at 0, 4, 8 and 12 weeks. A two-sample Wilcoxon rank-sum (Mann- Whitney) test was used when data deviate from normality, and p value less than 0.05 is considered statistically significant.

Results

Characteristics of Subjects

Baseline clinical characteristics and anthropometric data of control obese (CObe; n=15) and exercise obese (ExOb; n=17) adult Thais are shown in Tables 1 and 2 Data of baseline characteristics, anthropometry, physical performance and 6MWT showed no significant differences at pre-exercise (week 0) in age, height, body weight (BW), body mass index (BMI), percentage of total body fat, waist circumference (WC), hip circumference (HC), waist to hip ratio (WHR), systolic blood pressure (SBP), diastolic blood pressure (DBP) and heart rate (HR). Data of physical performance in both control and exercise groups of obese Thais (pre-test) were not significantly different in hand grip strength test, leg and back strength test and six-minute walk test (6MWT) when compared between control and exercise groups.

Anthropometry and Physical Performance

After 12 weeks of BWSH exercise, there were no significant differences in BW, BMI, WC and WHR, SBP, DBP and HR at weeks 4, 8 and 12 between, control and exercise obese groups. Only hip circumference (HC) showed significant decreases at weeks 8 and 12 ($p<0.05$). In exercise group, percentages of total body fat showed highly significant decreases at week 4, week 8 and week 12 ($p<0.001$) (Table 1, Figure 1). Besides, results of hand grips ($p<0.05$) and leg strength ($p<0.01$) showed significant increases at week

4, week 8, week 12 in exercise obese group. Back strength showed significant increases at $p<0.05$ only at week 8 and week 12 ($p<0.05$) when compared to control obese group.

Cardiopulmonary Function

The results of cardiopulmonary function test by a six-minute walk test (6MWT) showed an increase from 560.59 ± 52.02 to 589.53 ± 58.13 m at week 4 ($p<0.01$) and increase from 560.59 ± 52.02 to 620.18 ± 56.87 m and 560.59 ± 52.02 to 635 ± 64.57 m at week 8 and week 12 ($p<0.001$) in obese exercise group (Table 2, Figure 2).

Discussion

BWSH on Anthropometry and Physical Performance

From this study, 12 weeks of BWSH exercise training did not reduce BW, BMI, WC or WHR. Similarly, as a study on aerobic exercise training, for example, walking, climbing, cycling and aerobics, which are prescribed for treating obesity, do not always play an important role in weight loss [16]. Some studies have demonstrated that exercise training is associated with intra-abdominal fat (IF) reduction [17]. Other studies reported that resistance exercise results in a decreased fat percentage, with the suggestion that it is due to a decrease in fat mass [18-20]. HC was decreased significantly after 4 and 8 weeks of BWSH exercise training. Swaying hip exercise training possibly contributed to a decrease in HC. This finding is the first time to combine aerobic exercise of brisk walking and swaying hips with hand weight load. Similarly, after 12 weeks of abdominal resistance exercise, there were decreases in abdominal subcutaneous fat, waist circumference, hip circumference in obese women [21]. This may be due to increased energy expenditure utilization than normal exercise resistance. Because this study designed by adding sway hips with hand weight load which is probably responsible for a reduced total body fat observed in this study. This finding is in agreement with other studies that the physical exercise aids on the body fat burn [22-23]. The regular physical activity promotes metabolic adaptations that facilitate the regulation of energy and fat balance. Physical activity favors a negative energy and fat balance particularly if activities are prolonged and vigorous [24].

Muscle strength is a factor of physical performance parameter. This study used hand grips, back and leg strength tests for measurement of muscle strength. Results showed increases in back strength, leg strength and hand grip strength. Maximum force can be exerted by a muscle contraction [25]. Similarly, strength is defined as the ability of a muscle group to develop maximal contractile force against a resistance in a single contraction [26]. Endurance and resistance training increases muscle strength. Combination exercise training should be recommended for overweight and obese adults [27]. Resistance training-also known as strength or weight training-has been well recognize by several national organizations

as a safe and beneficial exercise modality for the health and resistance exercise improves muscular strength in obese adolescents [28].

BWSH on Cardiopulmonary Function

This study increased 6MWT exercise obese groups after BWSH exercise at weeks 4, 8 and 12. The original purpose of the six minute walk was to test exercise tolerance in chronic respiratory disease and heart failure. The test has since been used as a performance-based measure of functional exercise capacity in other populations including healthy adults and patient [13]. The results of this study similar to the previous study showed that 6MWT increased during a weight reduction program, indicating improvement of physical fitness and decreased metabolic demand during daily activity in overweight children and adolescents [14, 29]. Brisk marching equivalent to a moderate aerobic exercise was increased in six-minute walk test [30]. Increased sway has also been observed in pre-pubertal boy [31]. Though obese individuals may be able to accommodate for the extra mass in terms of balance because they walk with it every day, several studies have found that obese people spend more time in the stance rather than swing phase during the walking cycle and increase double support time [32-33].

Conclusions

This study suggests that 12 weeks of brisk walking with swaying hips and hand weight load training can improve physical performance, cardiopulmonary function and reduce total body fat in male and female obese Thai adults.

Future Study

According to the study, BWSH exercise is a good exercise model for health promotion in obese Thai adults especially in improvement of physical performance and cardiopulmonary function. Therefore, BWSH exercise may be recommended to implement to other group of subjects such as diabetes, hypertension, dyslipidemia, metabolic syndrome and elderly for health care and health promotion as well.

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Table 1 Baseline characteristics and anthropometry in control obese (COb; n=15) and exercise obese (ExOb; n=17) Thai adults.

Variables	Pre - test (week 0)		week 4		week 8		Post - test (week 12)	
	COb	ExOb	COb	ExOb	COb	ExOb	COb	ExOb
BW (kg)	90.3 ± 13.1	90.8 ± 16.5	91.0 ± 13.1	88.2 ±16.6	90.4 ± 12.1	87.5 ± 15.9	91.0 ± 14.1	87.0 ± 16.4
BMI (kg/m^2)	31.5 ± 2.1	32.2 ± 3.1	31.5 ± 2.3	31.2 ± 3.1	31.5 ± 2.3	31.0 ± 3.0	31.5 ± 2.3	30.9 ± 3.2
WC (cm)	97.1 ± 8.0	99.3 ± 11.4	96.1 ± 7.8	97.7 ± 11.8	96.8 ± 7.5	97.4 ± 9.5	96.1 ± 7.8	95.6 ± 11.3
HC (cm)	111.2 ± 5.4	112.4 ±7.7	111.6 ± 5.7	111.0 ± 7.3	112.4 ± 7.7	109.8 ± 6.8*	112.3± 7.5	109.9 ± 7.4*
WHR	0.82 ± 0.13	0.88 ± 0.05	0.82 ± 0.16	0.88 ± 0.06	0.82 ± 0.15	0.89 ± 0.05	0.82 ± 0.16	0.86 ± 0.05
SBP (mm Hg)	120.1 ± 8.7	120.1 ± 8.1	119.7 ± 9.3	117.7 ± 6.5	120.1 ± 8.7	118.5 ± 7.1	119.7 ± 9.0	116.8 ± 7.6
DBP (mm Hg)	73.3 ± 7.1	78.4 ± 7.6	73.6 ± 7.2	78.1 ± 7.2	73.4 ± 7.0	78.0 ± 8.6	73.6 ± 7.0	77.5 ± 8.3
HR (bpm)	78 ± 11	79 ± 11	79 ± 13	80 ± 10	77 ± 11	83 ± 13	79 ± 13	76.0 ± 10.6
%Total body fat	29.5 ± 5.3	28.7 ± 5.5	29.7 ± 5.4	24.5 ± 7.1***	29.6 ± 5.7	23.6 ± 3.4***	29.7 ± 5.4	23.4 ± 4.9***

Data are presented as mean ± SD. 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; HR, heart rate and Percentage (%)of total body fat.

* $p<0.05$ Significantly different, and *** $p<0.001$ Highly significant difference in COb versus ExOb by paired t-test.

Table 2 Physical performance and six minute walk test (6MWT) in control obese (COb; n=15) and exercise obese (ExOb; n=17) Thai adult.

Variables	Pre - test (week 0)		week 4		week 8		Post - test (week 12)	
	COb	ExOb	COb	ExOb	COb	ExOb	COb	ExOb
Hand grip strength test (kg)	30.6 ± 6.0	32.3 ± 10.3	30.85 ± 6.6	36.41± 8.9*	30.75 ± 6.8	36.8 ± 9.5*	30.8 ± 6.6	35.7 ± 9.0*
Back strength test (kg)	79.2 ± 20.6	88.4 ± 30.1	79.16 ± 21.4	91.47 ± 36.4	78.16 ± 20.7	102.9 ± 43.6*	78.1 ± 20.3	101.7 ± 36.4*
Leg strength test (kg)	104.7 ± 40.2	111.4 ± 43.5	104.52 ± 40.1	127.11 ± 42.1**	104.44 ± 40.2	133.5 ± 47.0**	104.5 ± 40.1	143.5 ± 39.4**
Six-minute walk test (m)	596.96 ± 90.34	560.59 ± 52.02	596.62 ± 89.74	589.53 ± 58.13**	595.21 ± 88.45	620.18 ± 56.87***	592.62 ± 89.34	635.0 ± 64.57***

Data are presented as mean ± SD.

* $p<0.05$ Significantly different, ** $p<0.01$ High significant difference and *** $p<0.001$ Highly significant different in COb versus ExOB by paired t-test.

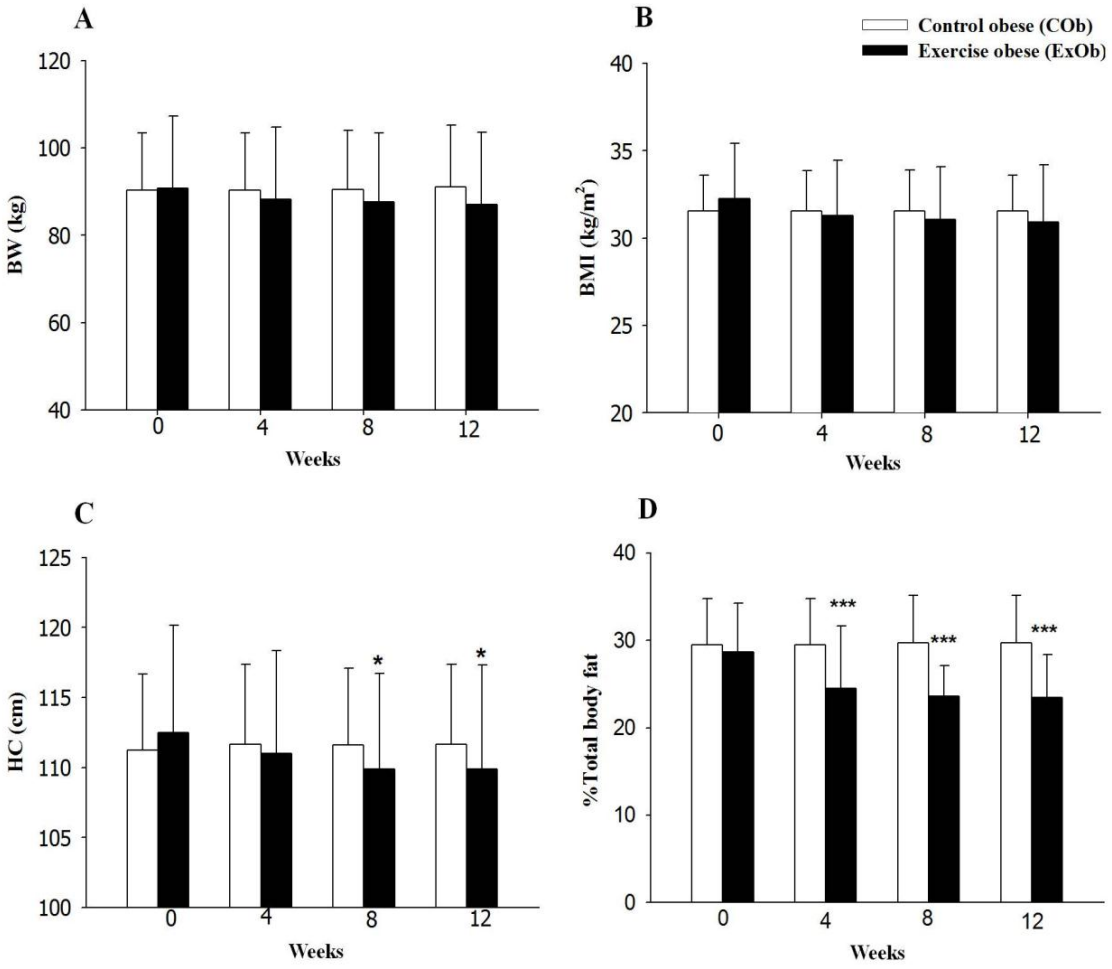

Figure 1 The measurements of BW (A), BMI (B), HC (C) and %Total body fat (D) at weeks 0, 4, 8 and 12. All data were compared between control obese (COb; n=15) versus exercise obese (ExOb; n=17). Data are shown as mean ± SD.

* $p<0.05$ Significantly different, and *** $p<0.001$ Highly significant difference in COb versus ExOB by paired t-test.

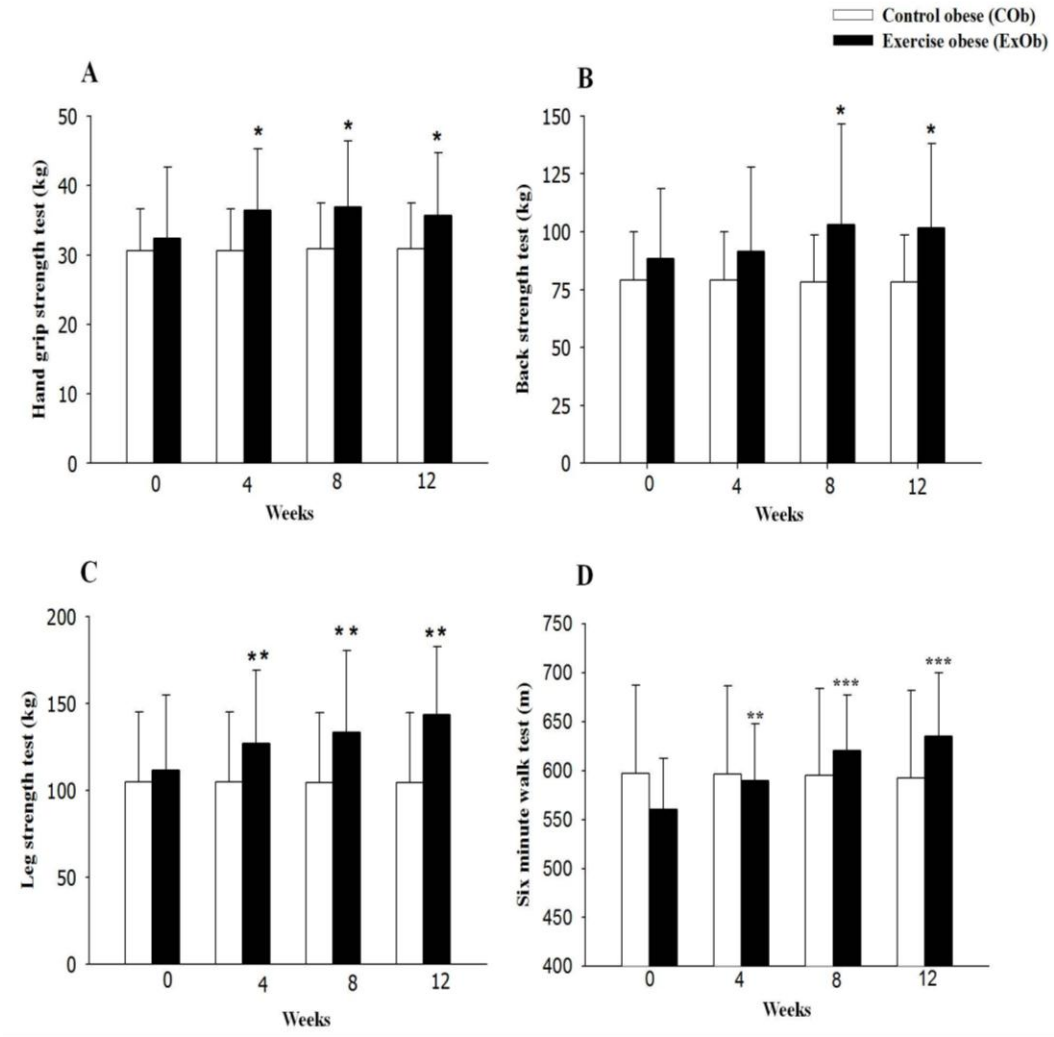

Figure 2 The measurements of hand grip strength test (A), back strength test (B), leg strength test (C) and six minute walk test (D) at weeks 0, 4, 8 and 12. All of data were compared between control obese (COb; n=15) versus exercise obese (ExOb; n=17). Data are shown as mean ± SD.

* $p<0.05$ Significantly different, ** $p<0.01$ High significant difference and *** $p<0.001$ Highly significant difference in COb versus ExOb by paired t-test.