A Comparison between the Effects of the Walking Exercise with and without Weighted Vests on Bone Resorption and Health-Related Physical Fitness in the Working Women

Nisakorn Tantiwiboonchai MSc*,
Thanomwong Kritpet PhD*, Pongsak Yuktanandana MD**

** Faculty of Sports Science, Chulalongkorn University, Bangkok, Thailand*
*** Department of Orthopedics, Faculty of Medicine, Chulalongkorn University, Bangkok, Thailand*

The purpose of the present study was to compare the effects of walking exercise with and without weighted vests on bone resorption and health-related physical fitness in the working women. Forty-eight female staff of Chulalongkorn University who were 30-60 years old voluntarily participated in the study. The subjects were randomly assigned into two groups: the experimental group performing the walking exercise wearing the weighted vests (EW, n = 24) and the control group performing the walking exercise without wearing the weighted vests (E, n = 24). The treatment was the 30-minute walking exercise on treadmill at 0% of grade, 3 times per week for 12 weeks at the intensity of 65-75% of the maximal heart rate. The first two weeks, the EW group walked without the weighted vests. Starting from the third week, the vest load was progressively increased each week with 2% of each participant's body weight until it reached 8% in the sixth week. Bone formation (P1NP), bone resorption (β-crossLaps) and health-related physical fitness were collected. The obtained data were analyzed in terms of the mean, standard deviation, paired t-test, one way analysis of covariance, one way analysis of variance with repeated measure and the multiple comparisons by using Least Significant Difference (LSD) at the 0.05 level.

Prior to the experiment, the mean age and the BMD of the experimental group were 41.54 ± 8.08 yrs and -0.57 ± 1.14, respectively. The control group has the mean age of 46.00 ± 7.47 and BMD of -0.53 ± 1.09. After 12 weeks of the training, there was no statistical difference in bone formation marker, bone resorption marker and health-related physical fitness between the experimental group and the control group. Moreover, the reduction of 19.143% and 21.849% of bone resorption marker in Group EW and Group E, respectively were found. Other health-related physical fitness, e.g., the muscle strength and endurance of legs and arms and the maximum oxygen uptake in both groups were significantly improved.

In conclusion, the walking exercise with and without the weighted vests can reduce bone resorption and improve health-related physical fitness. This type of exercise is an alternative way to prevent bone resorption for the working women.

Keywords: *Walking exercise, Weighted vests, Bone resorption β-crossLaps (CTx), Health-related physical fitness*

J Med Assoc Thai 2011; 94 (Suppl. 5): S24-S30
Full text. e-Journal: *http://www.mat.or.th/journal*

Bone is an important body structure and is experienced the remodeling process throughout the time from childhood until 20 years old. During this period, the body can accumulate peak bone mass. The peak bone mass is constant until the age of 30[1,2]. The bone is continuously remodeling as a result of osteoblastic (formation) and osteoclastic (resorption) activity. This dynamic and effective process of remodeling acts as a source of stored bone and calcium and its result was correlated closely with physical activities (mechanic loading on bone), nutrition and aging. Women become to lose bone mass between 30 and 35 years of age at the rate of 0.75% to 1.0% per year[1]. For the menopause women, estrogen hormone drops down rapidly. As a result, the density of bone mass decreases faster than men who are at the same age. Women have three times a greater risk to experience osteoporosis more than men[2,3].

There are many methods of osteoporosis prevention and treatment. Exercise is a viable alternative for the prevention of osteoporosis. The weight bearing

Correspondence to:
Kritpet T, Faculty of Sports Science, Chulalongkorn University, Bangkok 10330, Thailand.
Phone: 0-2218-1012
E-mail: Thanomwong.k@chula.ac.th

exercise such as a fast walking or walking up and down the stairs, running, yoga, playing tennis, etc were mentioned to gain healthy bone(2-6). Moreover, some researchers(4-8) suggested the weight wearing while doing exercise. Snow et al(4) studied the long-term exercise using weighted vests to prevent hip bone loss in postmenopausal women. They combined the weighted vests (11 pounds) with the jumping exercise. The finding was that the training group had a loss of bone mass less than the non training group. This showed that exercising with weighted vests could increase the compression pressure on hip and spine. However, it can slow down the degradation process of bone mass as Wolf's theory(9) confirmed that the force or weight (weight bearing) directly pressing on bone led to the increase of bone component and bone strength.

The menopause or aged women have been widely studied in most researches because the bone mass of the working women at the age of 30 and more reduce slowly. The bone becomes very thin in very elderly women, especially in their spine bone and hip bone where the high risks for fractures are(3). When receiving the early signs of an osteoporosis risk, the methods of prevention and healing are very necessary. Moreover, several studies(4,5,7) have compared the effect of weighted vest exercise with the effect of exercise or hormone therapy. Nevertheless, there is no research on the comparison of the results of wearing the weighted vests undertaking the same exercise. The present study, thus, aimed to investigate the effects of the exercise that Thai working women walked with and without the weighted vests; which type of the exercise strengthened and decomposed the bone and health capability; and also how heavy the weighted vests were suitable for Thai women.

Material and Method

Subject selection and criterion

Forty-eight female Chulalongkorn University staff volunteered to participate in the experiment. The inclusion criteria were as follows: healthy sedentary women at the age of 30-60, no smoking and no alcoholic drinking, no hormonal replacement therapy (HRT), drinking tea or black coffee not more than 2 standard cups per day (250 cc/cup), doing exercise not more than twice per week, BMD not less than -3 SD, BMI not more than 30 kg/m^2 and no heart diseases. The subjects would be excluded if they neither continuously join the program nor participate in our exercise more than 2 weeks. They were also excluded if they were injured or sick during the experiment. The subjects were randomly assigned into two groups: the experimental group (EW) and the control group (E).

Instrument

The selection instruments were a questionnaire about health, and the SAHARA^R BMD to measure the heel bone density (BMD).

The Experimental instruments were two programs of the walking exercise on treadmill (OZ1, Marathon, Thailand) at 0% of grade: one wearing weighted vests called Group EW and the other not wearing weighted vests called Group E. Each program lasted 30 minutes, 3 times per week for 12 weeks. The speed of the treadmill was controlled by using M53 Polar heart rate monitor in order to achieve 65-75% of each participant's maximum heart rate.

The health-related physical fitness testing were a body composition using the bioelectrical-impedance analysis (220, Inbody), maximum oxygen uptake using modified Balke treadmill test, flexibility using sit and reach test, legs muscular strength and endurance using 1 minute chair sit to stand test, arms muscular strength and endurance using 1 minute modified push up test. The testing instruments for bone formation and bone resorption were Elecsys 2010 "Hitachi" brand Japan, β-crossLaps and P1NP biochemical testing of Roche Diagnostics (Thailand) Co. Ltd.

The ground-reaction force testing was used for walking on treadmill with force plate (QUALISYS) at speed of 1.51 m/s (corresponding to 5.4 km/h) while wearing the weighted vests at 8% of the body weight and without the weighted vests. The outcome measures were the peak vertical force with the weighted vests (668.52 N) and without the weighted vests (629.64 N) during the gait cycle.

Material and Method

Before the experiment, the biochemical bone markers were tested by using the blood test in order to gain β-crossLaps (ng/ml) and P1NP (ng/ml) value. The walking exercise with the weighted vests training program was validated by 6 experts using the face validity method. Then, the instruments were conducted to collect the data. Before starting the walking exercise program, the experimental group and the control group had taken the pre-test by using the research instruments. After taking the pre-test, the control group started the walking exercise without the weighted vests program and the experimental group started the walking exercise with the weighted vests program. The walking exercise consisted of 1) a 5-minute slow walk (warm-up), 2) a 30- minute fast walk (exercise) in the mean time the heart rate was maintained at the intensity of 65-75% of the maximal heart rate which was monitored continually throughout the walking protocol by the program supervisor who used the Polar heart rate monitor (M53 system) and 3) a 5-minute slow walk (cool-down).The exercise training was 3 times per week for a period of 12 weeks at a fitness center of Faculty of Sports Science, Chulalongkorn University. The experimental group wearing the weighted vests which the vest load was progressively increased each week starting from 2% of the body weight from Week 3 and progressively increased 2% every week until it reached 8% of the body weight of each participant (Figure 1). Finally, the subjects took the mid-test and the post-test, except the biochemical bone testing.

Statistics

The data were computer-analyzed by using the mean scores, standard deviation, percentage of change, paired t-test and one way analysis of covariance, one way analysis of variance with repeated measure and the multiple comparisons by using Least Significant Difference (LSD) to test the statistical significance at the 0.05 level.

Results

The characteristic data of the subjects were complete trial, 24 subjects in the experimental group and 24 in the control group. There were no significant differences in the mean age, height and T score (Table 1).

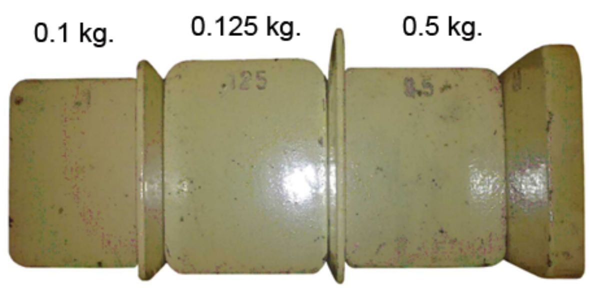
After the 12-week experiment training, the findings indicated that the mean scores on bone resorption (β-crossLaps) and bone formation (P1NP) of the experimental group and the control group were not significantly different at the 0.05 level. However, the results showed that bone resorption were significantly decreased from the pre-test to the post-test in the experiment group ($p = 0.01$) and the control group ($p = 0.00$) (Table 2).

After the 6-week training, the diastolic blood pressure ($p = 0.02$) and the maximum oxygen uptake ($p = 0.05$) were significantly different between the experimental group and the control group. After the 12-week training, the diastolic blood pressure significantly decreased from the pre-test to the post-test in Group EW. The health-related physical fitness of both groups such as the muscle strength, the endurance of legs and arms and the maximum oxygen uptake were significantly increased from the pre-test to the post-test (Table 3).

Discussion

In the present study, the walking exercise wearing the weighted vests (EW) and the walking exercise without wearing the weighted vests (E) had no different effects on bone formation (P1NP), bone resorption (β-crossLaps) and health related physical

a) Pattern of the weighted vest



b) The weighted pieces (made of iron)

Fig. 1 Weighted vests

Table 1. Subject characteristics (the mean ± SD)

	Experimental group(EW: n = 24)	Control group (E: n = 24)
Age (year)	41.54 ± 8.08	46.00 ± 7.47
Height (cm)	156.10 ± 4.00	154.87 ± 6.35
T score (BMD of the right heel)	-0.57 ± 1.14	-0.53 ± 1.09

Table 2. Biochemical bone marker indexes before and after 12 weeks of the walking exercise (the mean ± SD)

	Experimental group (EW: n = 24)			Control group (E: n = 24)		
	Pre-test	Post-test	% change	Pre-test	Post-test	% change
Bone resorption						
β-crossLaps (ng/ml)	0.350 ± 0.227	0.283 ± 0.132 *	-19.143	0.357 ± 0.168	0.279 ± 0.137 *	-21.849
Bone formation						
P1NP (ng/ml)	43.668 ± 14.886	41.499 ± 16.119	-4.967	44.108 ± 17.460	42.937 ± 16.660	-2.655

* Difference from the pre-test is significant at the .05 level

fitness. The result showed that the weighted vest (8% of the body weight) was not heavy enough to act as a stimulus on bone and health-related physical fitness. This finding was similar to Greendale et al[10]. They used the weighted vests (5% of the body weight) 2 hours daily, 4 days per week, for 24 weeks of the treatment when performing the recreational activities *e.g.* walking, doing house keeping work, etc. in older adults. They found no effects on the muscle strength, physical function, bone turnover and health-related physical fitness. Some researches[4,5,7] used the weighted vests that could improve the bone mineral density because the weighted vests were used as a part of the multiple exercises. The weighted vests were 15-20% of the body weight for a long term study. Those researches were the comparison studies between the exercise group and the non exercise group of which the effects of doing exercise showed more difference than the ones of the non performing exercise. In the present study, the weight was progressively increased each week. It was done the same as those mentioned researches did. The weight was maintained at 8% of the body weight for 6 weeks because the safety of the subjects was firstly considered as they had never worn the weighted vests before, particularly wearing the weighted vests while doing exercise.

After 6 weeks, the maximum oxygen uptake and the diastolic blood pressure were significantly different between the EW group and the E group. The maximum oxygen uptake in the EW group was increased more than the E group and the diastolic blood pressure in the EW group was more decreased than the E group. The walking exercise with the weighted vests gained the body weight during the exercise while the oxygen uptake increased[11] because the body required more energy than doing exercise without the weighted vests[12]. So, the walking exercise with the weighted vests can adapt the cardiovascular function greater than the exercise without the weighted vests. However, after the 12-week training, there was no significant difference between the E group and the EW group which, in the last 6 weeks of the training, had neither more weight adding nor the exercise adaptation.

Others studies[2,3,6,13] insisted that the weight bearing exercise such as walking, running, yoga training and weight training reduced bone resorption and increased bone mineral density. The present study confirms that the fast walking classified as a moderate exercise is an effective exercise for preventing bone loss which reduces bone resorption (β-crossLaps)[8,14-17]. β-crossLaps significantly decreased in the EW group and the E group. This result indicated a decrease in osteoclastic, but P1NP in all groups were not significantly changed. It might imply that the cycle of bone formation had a long duration to complete the process[12]. Some previous studies[7,14] showed the significant decrease in bone resorption (amino terminal peptide: NTx). They stated that the exercise was an anti-resorptive effect on bone in the working women who were premenopausal, menopause or postmenopausal. The walking exercise which had a ground reaction force greater than 1.2-1.6 times of the body weight[15,18] and of which the peak force transmitted to whole body such as ankle, knee, hip and spine etc.[18], was called the peak force of walking exercise. This exercise had a more impact on the mechanism of bone remodeling unit than the normal activity. The peak force of walking exercise can decrease the activity of osteoclast and increase the activity of osteoblast[1]. Weight and force across the bone are sensed by the osteocyte as a mechano-sensor of bone. The responses to this process stimulate bone formation and reduce the rate of bone resorption[19].

Therefore, the two walking exercise programs clearly improve healthy bone and health-related physical fitness within 12 weeks.

Table 3. Responses of the physiological data and health-related physical fitness (the mean ± SD)

	Experimental group (EW: n = 24)			Control group (E: n = 24)		
	Pre-test	Mid-test	Post-test	Pre-test	Mid-test	Post-test
Physiological data						
Weight (kg)	55.11 ± 6.85	55.22 ± 6.87	55.17 ± 6.94	56.39 ± 9.05	56.67 ± 9.13	56.47 ± 8.92
BMI (kg/m^2)	22.65 ± 2.91	22.73 ± 2.95	22.94 ± 2.93	23.51 ± 3.42	23.61 ± 3.50	23.49 ± 3.49
Heart rate resting (bpm)	78.00 ± 9.95	75.21 ± 8.14	75.21 ± 8.57	82.08 ± 11.05	79.17 ± 9.15	78.08 ± 10.36
Systolic blood pressure (mmHg)	112.54 ± 14.58	109.37 ± 12.79	107.42 ± 13.64	116.17 ± 13.96	113.08 ± 14.36	113.25 ± 15.76
Diastolic blood pressure (mmHg)	73.71 ± 12.50	67.54 ± 8.15*++	65.96 ± 9.37*	73.04 ± 13.97	72.25 ± 11.64	70.00 ± 12.29
Health-related physical fitness						
Body composition						
Muscle mass (kg)	20.12 ± 2.14	20.29 ± 2.09	20.60 ± 2.17	19.49 ± 2.38	19.79 ± 2.40	19.95 ± 2.19
Fat mass (kg)	17.69 ± 4.52	17.51 ± 4.59	16.95 ± 4.60	20.14 ± 6.72	19.93 ± 6.85	19.44 ± 6.88
Fat (%)	31.66 ± 5.46	31.25 ± 5.50	30.27 ± 5.70	34.91 ± 6.85	34.33 ± 7.08	33.52 ± 7.21
Flexibility						
Sit and reach (cm)	8.04 ± 5.74	8.45 ± 5.93	10.79 ± 5.87	2.58 ± 7.60	4.00 ± 6.87	6.71 ± 5.90*
Muscle strength and endurance (times/min)						
Legs: chair sit to stand	24.21 ± 5.63	26.42 ± 5.82	33.46 ± 7.98*#	23.25 ± 5.60	27.00 ± 6.29*	32.75 ± 7.95*#
Arms: modifies push up	24.42 ± 8.41	28.12 ± 7.43	31.87 ± 9.23*	21.96 ± 9.19	27.08 ± 8.38*	31.29 ± 9.14*
Maximum oxygen uptake						
VO_2max (ml/kg/min)	30.22 ± 4.44	34.60 ± 3.95*++	40.74 ± 5.30*#	26.92 ± 5.45	30.25 ± 5.60*	35.97 ± 6.24*#

* Difference from the pre-test is significant at the 0.05 level
# Difference from the mid-test is significant at the 0.05 level
++ Difference from the control group is significant at the 0.05 level

Acknowledgement

This research was funded by Graduate School and Faculty of Sports Science, Chulalongkorn University. The authors wish to thank the subjects who volunteered for the present study. The authors also appreciate the Faculty of Medicine, Chulalongkorn University and Bureau of Sports Science, Office of Sports and Recreation Development for providing the laboratory service and the expertise. The authors gratefully thank Narong Bunyaratavej MD for the valuable discussions.

Potential conflicts of interest

None.

References

1. American College of Sports Medicine. ACSM's Resource manual for guidelines for exercise testing and prescription. 5th ed. Philadelphia: Lippincott Williams and Wilkins; 2006.
2. Kohrt WM, Bloomfield SA, Little KD, Nelson ME, Yingling VR. American College of Sports Medicine Position Stand: physical activity and bone health. Med Sci Sports Exerc 2004; 36: 1985-96.
3. Back RB, Shaw J, Snow CM. Physical activity and osteoporosis. In: Marcus R, Feldman D, Kelsy J, editors. Osteoporosis. San Diego: Academic Press; 2001: 701-20.
4. Snow CM, Shaw JM, Winters KM, Witzke KA. Long-term exercise using weighted vests prevents hip bone loss in postmenopausal women. J Gerontol A Biol Sci Med Sci 2000; 55: M489-91.
5. Milliken LA, Going SB, Houtkooper LB, Flint-Wagner HG, Figueroa A, Metcalfe LL, et al. Effects of exercise training on bone remodeling, insulin-like growth factors, and bone mineral density in postmenopausal women with and without hormone replacement therapy. Calcif Tissue Int 2003; 72: 478-84.
6. Kohrt WM, Ehsani AA, Birge SJ Jr. Effects of exercise involving predominantly either joint-reaction or ground-reaction forces on bone mineral density in older women. J Bone Miner Res 1997; 12: 1253-61.
7. Klentrou P, Slack J, Roy B, Ladouceur M. Effects of exercise training with weighted vests on bone turnover and isokinetic strength in postmeno-pausal women. J Aging Phys Act 2007; 15: 287-99.
8. Tosun A, Bolukbasi N, Cingi E, Beyazova M, Unlu M. Acute effects of a single session of aerobic exercise with or without weight-lifting on bone turnover in healthy young women. Mod Rheumatol 2006; 16: 300-4.
9. Nelson ME, Fisher EC, Dilmanian FA, Dallal GE, Evans WJ. A 1-y walking program and increased dietary calcium in postmenopausal women: effects on bone. Am J Clin Nutr 1991; 53: 1304-11.
10. Greendale GA, Salem GJ, Young JT, Damesyn M, Marion M, Wang MY, et al. A randomized trial of weighted vest use in ambulatory older adults: strength, performance, and quality of life outcomes. J Am Geriatr Soc 2000; 48: 305-11.
11. Francis K, Hoobler T. Changes in oxygen consumption associated with treadmill walking and running with light hand-carried weights. Ergonomics 1986; 29: 999-1004.
12. McArdle WD, Katch FI, Katch VL. Essentials of exercise physiology. 2nd ed. Philadelphia: Lippincott Williams and Wilkins; 2000.
13. Phoosuwan M, Kritpet T, Yuktanandana P. The effects of weight bearing yoga training on the bone resorption markers of the postmenopausal women. J Med Assoc Thai 2009; 92 (Suppl 5): S102-8.
14. Hatori M, Hasegawa A, Adachi H, Shinozaki A, Hayashi R, Okano H, et al. The effects of walking at the anaerobic threshold level on vertebral bone loss in postmenopausal women. Calcif Tissue Int 1993; 52: 411-4.
15. Borer KT, Fogleman K, Gross M, La New JM, Dengel D. Walking intensity for postmenopausal bone mineral preservation and accrual. Bone 2007; 41: 713-21.
16. Thorsen K, Kristoffersson A, Lorentzon R. The effects of brisk walking on markers of bone and calcium metabolism in postmenopausal women. Calcif Tissue Int 1996; 58: 221-5.
17. Yamazaki S, Ichimura S, Iwamoto J, Takeda T, Toyama Y. Effect of walking exercise on bone metabolism in postmenopausal women with osteopenia/osteoporosis. J Bone Miner Metab 2004; 22: 500-8.
18. Nordin M, Frankel VH. Basic biomechanics of the musculoskeletal system. 3rd ed. Philadelphia: Lippincott Williams and Wilkins; 2001.
19. Songpattanasilp T. Progress in bone biology: the reviews and new insights. In: Narong B, editor. Bone forum. Bangkok: Concept Medical; 2007: 1-35 (in Thai).

การเปรียบเทียบผลระหว่างการเดินออกกำลังกายแบบใส่เสื้อเพิ่มน้ำหนักและไม่ใส่เสื้อเพิ่มน้ำหนักต่อการสลายของกระดูกและสุขสมรรถนะในหญิงวัยทำงาน

นิศากร ตันติวิบูลชัย, ถนอมวงศ์ กฤษณ์เพ็ชร์, พงศ์ศักดิ์ ยุกตะนันทน์

วัตถุประสงค์ *: เพื่อเปรียบเทียบผลระหว่างการเดินออกกำลังกายแบบใส่เสื้อเพิ่มน้ำหนักและไม่ใส่เสื้อเพิ่มน้ำหนักต่อการสลายของกระดูกและสุขสมรรถนะในหญิงวัยทำงาน*

วัสดุและวิธีการ *: เป็นบุคลากรหญิงในจุฬาลงกรณ์มหาวิทยาลัย อาสาสมัครเข้าร่วมการวิจัยจำนวน 48 คน ช่วงอายุ 30-60 ปี ผ่านเกณฑ์คัดเข้าโดยวิธีสุ่มแบบง่ายเข้ากลุ่มเดินออกกำลังกายแบบใส่เสื้อเพิ่มน้ำหนัก และกลุ่มเดินออกกำลังกายแบบไม่ใส่เสื้อเพิ่มน้ำหนัก ทุกคนเดินบนลู่กลที่ระดับความชันศูนย์เปอร์เซ็นต์ ครั้งละ 30 นาที 3 ครั้งต่อสัปดาห์เป็นเวลา 12 สัปดาห์ ที่ความหนัก 65-75% ของอัตราการเต้นของหัวใจสูงสุด โดยกลุ่มทดลองเริ่มใส่เสื้อเพิ่มน้ำหนัก 2 % ของน้ำหนักตัวในสัปดาห์ที่ 3 และเพิ่มน้ำหนักครั้งละ 2 % ทุกสัปดาห์ จนครบ 8 % ของน้ำหนักตัว ในสัปดาห์ที่ 6 ทดสอบค่าสลายและสร้างมวลกระดูกด้วยขบวนการทางชีวเคมีก่อนและหลังการทดลอง ส่วนสุขสมรรถนะทดสอบก่อนการทดลอง หลังการทดลองสัปดาห์ที่ 6 และสัปดาห์ที่ 12*

ผลการศึกษา*: กลุ่มทดลองฝึกเดินออกกำลังกายแบบใส่เสื้อเพิ่มน้ำหนักมีอายุเฉลี่ย 41.54 ปี และกลุ่มควบคุมฝึกเดินออกกำลังกายแบบไม่ใส่เสื้อเพิ่มน้ำหนักมีอายุเฉลี่ย 46.00 ปี ทั้งสองกลุ่มไม่มีผู้ที่มีค่าความหนาแน่นมวลกระดูกที่ส้นเท้าต่ำกว่า -2.5 SD หลังการทดลอง 12 สัปดาห์ พบว่า ค่าสลายมวลกระดูกและค่าสุขสมรรถนะของทั้งสองกลุ่มไม่แตกต่างกันอย่างมีนัยสำคัญทางสถิติ แต่ทั้งสองกลุ่มมีเปอร์เซ็นต์การเปลี่ยนแปลงค่าสลายมวลกระดูกลดลงคือกลุ่มทดลองลดลง 19.143% และของกลุ่มควบคุมลดลง 21.849% ทั้งกลุ่มทดลองและกลุ่มควบคุมต่างมีพัฒนาการเพิ่มขึ้นของสุขสมรรถนะได้แก่ ความแข็งแรงและความอดทนของกล้ามเนื้อขาและแขน และสมรรถภาพการใช้ออกซิเจนสูงสุด*

สรุป*: ทั้งการฝึกเดินออกกำลังกายแบบใส่เสื้อเพิ่มน้ำหนักและไม่ใส่เสื้อเพิ่มน้ำหนัก มีผลทำให้การสลายของกระดูกลดลง และส่งผลดีต่อสุขสมรรถนะ ดังนั้นรูปแบบการเดินออกกำลังกายสามารถเป็นทางเลือกในการช่วยป้องกันการสลายมวลกระดูกในหญิงวัยทำงานได้*