

# The Efficacy of an Aerobic Exercise and Health Education Program for Treatment of Chronic Low Back Pain

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## Abstract

Low back pain is one of the most common and important musculoskeletal disorders. In addition, chronic low back pain can deteriorate the patient's physical, psychosocial and socio-economic status. The objective of this quasi-experimental research was to assess the efficacy of an aerobic exercise and health education program in the treatment of chronic low back pain. Seventy-two patients whose ages ranged from 30 to 50 years who had chronic low back pain were enrolled and randomly assigned into two groups. Eight men and 28 women in the experimental group participated in a series of 3 health education sessions and an aerobic exercise training program. Nine men and 27 women in the control group received regular health education and a lumbar flexion exercise program. After a 3-month period of treatment, the results revealed the experimental group had statistically significant improvement of pain score and resting pulse rates when compared to the values of the control group ( $p$ -value  $< 0.001$  and  $< 0.01$ , respectively). The average serum High Density Lipoprotein-Cholesterol (HDL-C) in the experimental group was also significantly higher ( $p$ -value  $< 0.05$ ) than that of the control group. This health education program is useful and may be applicable to patients with chronic low back pain as an alternative treatment.

**Key word :** Chronic Low Back Pain, Health Education Program, Aerobic Exercise, Cholesterol

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Back pain is a common problem ; it is the second leading symptom in all physician visits<sup>(1)</sup>. Low back pain affects approximately 80 per cent of all adults at sometime during their lives<sup>(2)</sup>. The most common low back pain is mechanical back pain of musculoskeletal origin in which symptoms vary with physical activity. It usually develops spontaneously and may be very painful, but it should be a benign and self-limiting condition. Although most individuals recover quickly from an acute episode, recurrences are common<sup>(3)</sup> and some of them develop chronic low back pain. In addition, chronic low back pain is a common cause of long-term limitation of activity in adults aged less than 45 years. People with chronic low back pain usually face medical, psychosocial and economic questions and conflicts<sup>(4)</sup>.

A wide range of conservative interventions has been advocated for the treatment of this chronically symptomatic condition. Educational cognitive and behavioral interventions are applied with successful long-term outcome<sup>(5-9)</sup>. Among various forms of treatment some types of back exercise are included to relieve pain and prevent it from recurring including flexion exercise, abdominal trunk curls, hamstring stretching, pelvic tilt exercise and general aerobic exercise e.g. swimming, biking and jogging<sup>(9-14)</sup>.

The purpose of this study was to evaluate the efficacy of an aerobic exercise and health education program in patients with chronic low back pain, with particular attention to pain intensity and other beneficial effects. In addition, regular health education and lumbar flexion exercise training program were compared.

## MATERIAL AND METHOD

Patients were recruited from an outpatient orthopaedic clinic of Ramathibodi Hospital. Seventy-two patients who had been having chronic low back pain for more than 3 months were asked if they would agree to participate in a clinical study. All consenting patients had a clinical diagnosis of mechanical back pain, usually aggravated by activity and relieved by rest. Smokers were excluded from the study. Ages of the enrolled patients were between 30-50 years. All patients had a routine plain radiograph, whose results showed neither bony deformity, sign of inflammation, infection nor abnormal architecture.

The patients were assigned randomly to one of two treatment groups, aerobic exercise and flexion back exercise. Block randomization was applied at the time decision was made to proceed with intervention ; a card withdrawn from an envelope indicated either aerobic exercise or flexion back exercise.

There were 17 men and 55 women. Nine men and 27 women had a flexion exercise program, which included regular health education, postural and behavioral instruction and a lumbar flexion exercise training program. Eight men and 28 women had an aerobic exercise program, a series of 3 health education sessions including a group discussion, a modeling, a demonstration and self practice. Non-steroidal anti-inflammatory drugs were not used, but analgesics were administered in cases with moderate or severe back pain.

Before the intervention, all patients rated back pain on a visual analog scale (VAS) as applied by Huskissen ranging from 0 (no pain) to 10 (severe pain)<sup>(15)</sup>. Resting pulse, blood pressure in lying position, height, body weight, socioeconomic status, underlying disease, level of education, occupation, activity and serum for High Density Lipoprotein-Cholesterol (HDL-C) were also recorded. The scoring procedure was repeated at the final follow-up examination (after 12 weeks of intervention).

## Statistical analysis

The clinical results of the intervention were analyzed with the use of Student's *t*-test of independent samples, paired samples *t*-test, Z-test and Mann-Whitney U-test.

## RESULTS

All except 4 completed the course of this study. One underwent an operation for discectomy during the course of treatment and three patients were lost to follow-up.

Comparison between the control group and the experimental group, the body mass index in the control group averaged 24.1 kg/m<sup>2</sup> and in the experimental group it averaged 24.5 kg/m<sup>2</sup> with no statistical difference. Level of education and salary in the experimental group were higher than the control group, but with no statistical significance. Most patients in both groups were sedentary workers (Table 1).

Clinical outcome was assessed, according to relief of pain using visual analog scale, and im-

Table 1. Summary statistics for baseline characteristics of sample.

Characteristic	Experimental group n=35	Control group n=33	Chi-square	t test	p value
Mean age (yr)	42	39		1.63	NS
Female (%)	77	79	0.00		NS
Mean education (yr)	10.8	9.3		1.32	NS
Married (%)	71	76	0.02		NS
Mean BMI (kg/m <sup>2</sup> )	24.1	24.5		-0.46	NS
Sedentary work (%)	48.6	65.6	1.35		NS
Salary < 10,000 baht/mo (%)	34	48	1.76		NS
Mean duration of symptoms (mo)	42.3	33.0		0.70	NS
Disabled from Low back Pain (%)	14.3	24.2	1.15		NS
Mean VAS (0-10)	5.56	5.42		0.31	NS
Mean resting pulse rate (/min)	70.11	71.45		-1.10	NS
Mean serum HDL-C (mg/dl)	54.6	57.6		-1.08	NS

\* Independent sample *t* test was performed for comparisons of ratio and integer level data, and chi-square for dichotomous and nominal variables.

NS = not significant, BMI = Body Mass Index, VAS = Visual Analog Scale, HDL-C = High Density Lipoprotein Cholesterol

Table 2. Comparison of VAS, resting pulse rate, serum HDL-C.

Group	VAS		Resting pulse rate		Serum HDL-C	
	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD
<b>Between experimental group and controlled group after interventions.</b>						
Experimental group (n=35)	2.30	1.79	66.80	3.76	57.11	12.01
Controlled group (n=33)	3.97	1.92	70.24	6.22	56.12	11.58
	t = -3.71		t = -2.74		t = 0.37	
	p < 0.001		p < 0.01		p > 0.05	
<b>Within group of experimental group (n = 35)</b>						
Before intervention	5.56	1.80	70.11	3.85	54.60	11.36
After intervention	2.30	1.79	66.80	3.76	57.11	12.01
	t = 15.26		t = 5.27		t = -2.23	
	p < 0.001		p < 0.001		p < 0.05	
<b>Within group of controlled group (n = 33)</b>						
Before intervention	5.42	1.78	71.45	5.90	57.64	11.84
After intervention	3.97	1.92	70.24	6.22	56.12	11.58
	t = 5.97		t = 1.93		t = 1.31	
	p < 0.001		p > 0.05		p < 0.05	

proved from an average of 5.6 to 2.3 in the experimental group and from an average of 5.4 to 4.0 in the control group. Statistical analysis revealed a significant difference in results between the two groups (Student's *t*-test,  $p < 0.001$ ) (Table 2) and also a significant difference in reduction of back pain after a course of treatment in both groups (paired samples *t*-test,  $p < 0.001$ ) (Table 2).

Resting pulses in the experimental group were reduced after intervention from an average of 70.1/min to 66.8/min, whereas, in the control group they changed from an average of 71.5/min to 70.2/min. Statistical analysis showed a significant dif-

ference in the outcome between the two groups (Student's *t*-test,  $p < 0.01$ ). Furthermore, the change of resting pulses in the experimental group was also significantly different (paired sample *t*-test,  $p < 0.001$ ), but in the control group there was no statistical difference (Table 2). The proportion of patients who had reduction in resting pulses in the experimental group was also greater than that of the control group with statistical significance (Z-test,  $p < 0.001$ ).

Comparison of serum level of HDL-C in either gender between the two groups before intervention showed no statistical difference (Mann-

Table 3. Comparison of mean of difference in VAS, resting pulse rate, serum HDL-C between experimental group and controlled group after interventions.

Group	VAS		Resting pulse rate		Serum HDL-C	
	$\bar{d}$	SD	$\bar{d}$	SD	$\bar{d}$	SD
Experimental group (n=35)	-3.26	1.26	-3.31	3.72	2.51	6.66
Controlled group (n=33)	-1.45	1.40	-1.21	3.60	-1.51	6.63
	t = -5.60		t = -2.36		t = 2.55	
	p < 0.001		p < 0.05		p < 0.05	

Whitney-U test,  $p > 0.05$ ). After a course of treatment, a difference in the serum level of HDL-C was found (average 2.5 mg% in the experimental group, and 1.5 mg% in the control group) and this was a statistically significant difference (Student's *t*-test,  $p < 0.05$ ) (Table 3). In the experimental group, the proportion of patients with an increase in serum HDL-C was significantly higher than that of the control group (Z-test,  $p < 0.01$ ).

## DISCUSSION

In this quasi-experimental study; aerobic exercise, postural and behavioral instructions significantly affected the outcome of patients with chronic low back pain during a 12-week period. In the experimental group, pain scores were better than those of the control group who performed a lumbar flexion exercise.

The purposes of lumbar flexion exercise and postural training are to flatten the lumbar lordotic curve, stretch out tight back extensor muscles, strengthen the abdominal muscles and open the intervertebral foramen, thus, relieving nerve root compression. It is claimed that patients improve when doing lumbar flexion exercises. Reduction of lumbar back muscle spasm and a slight increase in sagittal plane range of motion were demonstrated (12,14). In this study, patients in the control group had improvement in pain score after the treatment from an average of 5.4 to 4.0 which was signifi-

cantly different but less beneficial than that of the experimental group.

The benefits of aerobic exercise are well accepted in many disorders namely hypertension, allergy and asthma. Besides the subsidence of clinical symptoms, aerobic exercise also improves cardio-pulmonary function and serum cholesterol (13,16,17). In the experimental group with aerobic exercise, patients experienced pain relief and other beneficial effects. Resting pulses were decreased significantly and serum HDL-C levels were increased significantly when compared with those of the control group. Such benefits did not occur in the control group.

Our study made no attempt to determine each subject's exercise preference before initiation of treatment. The enrolled subjects were voluntary and willing to participate in the study after having received complete information. If they were unavailable for exercise treatment either because of their time-schedule or physical fitness or any other reason, they were excluded from this study.

In summary, the results of the study demonstrated that aerobic exercise and a health education program are useful in the treatment of chronic low back pain, particularly in pain relief. An additional benefit of aerobic exercise is an increase in serum HDL-C, generally accepted as a preventive factor in coronary heart disease. So, aerobic exercise and a health education program offer another alternative treatment for patients with chronic low back pain.

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