

THE EFFECTS OF A COMPREHENSIVE HEALTH EDUCATION PROGRAM IN CHINESE PATIENTS AFTER PERCUTANEOUS CORONARY INTERVENTION

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ABSTRACT

OBJECTIVES: To determine how the comprehensive education program influences CHD risk factors in Chinese patients after PCI, and evaluate the effect of the comprehensive program. **METHODS:** A consecutive series of patients after PCI were recruited. They were randomly divided into the comprehensive education group and the ordinary education group. Patients were followed up by telephone or hospital visit. At 6 months and 12 months after PCI, the management of CHD risk factors in two groups was evaluated. **RESULTS:** Finally 64 patients in comprehensive group and 63 patients in ordinary group finished the follow-up study. Twelve months after PCI, patients in comprehensive group had much higher control ratio of all risk factors, compared to ordinary group. At 12-months cutoff date, the reductions of CHD risk factors in comprehensive group were significantly more than ordinary group. **CONCLUSIONS:** The comprehensive education program had more improved outcomes in CHD risk factors than ordinary one.

Received on: 3rd-Aug-2011

Revised on: 10th-Sept-2011

Accepted on: 15th-Sept-2011

Published on: 26th-Sept-2011

KEY WORDS

comprehensive health education program, CHD, PCI, risk factors

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[1] INTRODUCTION

With the steady improvement in medical technology, Percutaneous Coronary Intervention (PCI) acting as a safe, effective, non-surgical treatment for coronary heart disease (CHD) has become more and more perfect [1]. The demand for PCI has increased exponentially since the 1980s because it can re-canalize vasculature, and relieve symptoms quickly and effectively. However, the procedure does not stop the underlying process of atherosclerosis [2]. Even though the effect of PCI has been strengthened by the technological and pharmacological innovation, potential risk factors of CHD still remain a serious problem [3-5]. In 2007, the American College of Cardiology/American Heart Association (ACC/AHA) Task Force on Practice Guidelines created new "Focused Update" Guidelines for secondary prevention and long term management for patients with coronary and other vascular disease after PCI [6]. Health education has been integrated into the category of secondary prevention, encouraging people to adopt healthier lifestyles and further reducing the risk of CHD [7-9]. If post-PCI patients cannot pay attention to adopt healthier lifestyle because of an

absence of health education, irregular follow-up, or other reasons, this might lead to restenosis in endovascular stent, increasing the rate of re-hospitalize and rising mortality. Several studies have shown that the intervention programs resulted in significant reduction of body weight, waist circumference, serum lipids, serum glucose, blood pressure, and resting heart rate [10-13]. However, very few studies have been done on the effectiveness of the intervention programs in Chinese post-PCI patients. In developing countries like China, comprehensive health education programs are not widely spread.

Therefore, we established a comprehensive health education programs including discharge education on lifestyle modification, behavior change, and so on, central training after discharge, and frequent follow-up. The purpose of this study was to determine how this program influences CHD risk factors in Chinese patients after PCI, and evaluate the effect of the comprehensive program compared with an ordinary education program

[II] MATERIALS AND METHODS

2.1. Multiple Subjects

A consecutive series of patients who accepted the PCI were recruited from a metropolitan hospital in Taiyuan from July 2008 to December 2008. Ethical approval for the study was obtained from the Human Research Ethics Committees of the hospital. The study complied with the provisions of the Declaration of Helsinki. All patients provided written informed consent.

Inclusion criteria: 1. patients who accepted the PCI for the first time; 2. age \leq 75 years old; 3. the residents of Taiyuan city.

Exclusion criteria: 1. Patients who suffered from an unsuccessful PCI, and needed surgical operation; 2. Patients who suffered from psychotic diseases; 3. Patients who suffered from hearing disabilities and could not receive information in the study; 4. Patients who suffered from serious important organs dysfunctions and complications, such as malignant tumors, etc.

2.2. Study design

Subjects were stratified into 2 sub-strata, according to their sex and age ($<$ 60 years and \geq 60 years). Then Subjects in each sub-stratum were randomly divided into the intervention group and the control group. In the intervention group, comprehensive health education intervention was implemented. In the control group, ordinary health education was given. Single-blind method was carried out in this study. In order not to influence the results of intervention effects, subjects were informed not to communicate with each other. Patients were followed up by telephone or hospital visit. At 6 months and 12 months after PCI, the management of CHD risk factors in two groups was evaluated, and then conclusion was drawn after statistical analysis.

2.3. Intervention and Control

Comprehensive health education program including centralized training and telephone follow-up was carried out in the intervention groups. Ordinary health education program includes discharge guidance and distribution of health education materials [Table -1].

2.4. Contents of comprehensive health education:

Basic medical knowledge about CHD including secondary prevention of

post-PCI and correct administration was delivered to patients by cardiac physicians in the form of centralized training.

Healthy diet including the significance of health diet to rehabilitation in CHD, dietary principle of CHD, graphic presentation about healthy diet and correct cookery was instructed by dietitians in the means of centralized training.

Correct post-operation rehabilitation exercise including the effect of exercise to post-PCI rehabilitation, correct concepts of exercise, proper intensity of exercise, optimal exercise forms, appropriate exercise time was directed by both physicians and physical therapists.

Doctors and nurses tutored patients on how to quit smoking and refrain from drinking. The contents of lecture were composed of smoking hazard towards CHD, the benefits of withdrawal of smoking, the harms of great amount of drinking about CHD, and benefits of controlled alcohol intake.

2.5. Index Measurement

Smoking conditions (including smoking, refraining from smoking and non-smoking), exercise, conditions of medicine treatment about controlling risk factors of CHD (β -blockers and/or Angiotensin converting enzyme inhibitors, ACEI to control hypertension, and administrating statins to control hyperlipemia, and hypoglycemic agents to control hyperglycemia recommended in the PCI therapeutic manual) were thoroughly measured and analysed.

Physical check-up was carried out uniformly. The contents of physical check-up consist of CHD risk factors level data, such as height (HT), weight (WH), waistline (WC), systolic blood pressure (SBP), diastolic blood pressure (DBP), low density lipoprotein (LDL), fasting blood-glucose (FBG), etc.

2.6. Effects Evaluation Criteria

Goals of controlling risk factors of CHD in 2007 PCI Therapeutic Secondary Prevention Guidelines were selected as the criterion of evaluation. The standards were composed of BP $<$ 140/90mmHg, or $<$ 130/80mmHg (if patients were accompanied by diabetes mellitus); LDL $<$ 2.6mmol/L; FBG $<$ 6.1mmol/L; giving up smoking completely or avoiding non-smoking; the time of taking part in moderate aerobic exercise \geq 150minute/week, except for daily working and life. The predictive value of the 2 risk factors of CHD (BMI and WC) has ethnic difference, therefore, we chosen Asian standards proposed by WHO. The standards consisted of BMI:18.5 to 23.9 kg/m², WC: male $<$ 90cm, female $<$ 80cm [6,14,15].

Table: 1. The comprehensive health education programme

	Content
Object	The education about relevant medical common knowledge for the patients should be a part of training and follow-up visit, every patient received individualized and tailored educational plan;
Requirement	Making sure the patients understand the relation between lifestyle and health; Helping the patients acknowledge the CHD risk factors, and help them to change their lifestyles; Making plans with the patients and discuss more than once; Educating the patients don't rush to adjust many lifestyles at a time; Encouraging family members to join in the course of controlling risk factors so that the patients would be more likely to complete the plans. Monitoring the progress of patient's condition during the follow-up visit, Consulting with other medical personnel when necessary.
Health education practitioner	Clinical cardiologist : health education leaders, determine the health education project Heart disease nurses : telephone follow-up at fixed period, help the patients to change bad habits Register nutritionist : health diet education and consultation Community health service personnel : monitoring the risk factors of coronary disease, answering relevant health questions
Health education form	central training, telephone follow-up visit, community service

Abbreviations: CHD, coronary heart disease.

2.7. Statistical Analysis

Unless otherwise noted, all study data are described as mean \pm standard deviation (SD). Testing for baseline homogeneity across categories of BMI in each medication group was performed with ANOVA for continuous parameters and χ^2 test for categorical parameters. The reductions of CHD risk factors between two groups were compared using a general linear model. χ^2 test was used to assess the goal of control in coronary risk factors at 6 months and 12 months after PCI. A 2-tailed p value of 0.05 or less was considered significant. The statistical package used was SPSS version 17.0 (SPSS Inc., Chicago, Illinois).

[III] RESULTS

3.1. Patients

According to the inclusion and exclusion criteria, 163 patients were eligible for the study. However, 14 patients refused to join the study, and 13 patients could not be contacted. Finally, 136

patients were recruited in the study after endorsing the informed consent. They were randomly divided into intervention group (68 patients) and the control group (68 patients). A total of 4 patients in the comprehensive group and 5 in the control group were lost to follow-up or withdrew consent before the 12-month cutoff date, leaving 64 patients in education group and 63 patients in the control group.

Baseline characteristics were shown in **Table-2**, no significant differences of any characteristics were detected between the two groups. The mean age was 60 years, and 80% of patients were male. About 69% of patients were taking a β -blocker, 57% taking an ACEI, 68% taking a statin, and about 42% of patients are under anti-diabetes therapy. About 17% of patients had a habit of smoking, and did not refrain from smoking before enrollment. The levels of cardiovascular risk factors of CHD were similar in the two groups.

Table: 2. Baseline characteristics

	Comprehensive health education (n=64)	Ordinary health education (n=63)	p value
Mean \pm SD			
Age	59.4 \pm 10.1	60.6 \pm 10.7	0.520
SBP	136.1 \pm 13.3	135.9 \pm 12.9	0.939
DBP	84.9 \pm 11.1	84.0 \pm 10.2	0.663
LDL	107.1 \pm 28.3	107.8 \pm 26.4	0.891
FBG	103.7 \pm 25.8	104.0 \pm 18.4	0.937
BMI	23.7 \pm 1.4	23.9 \pm 1.5	0.673
WC	91.2 \pm 5.9	91.4 \pm 5.8	0.862
N(%)			
Male	51(79.7)	51(81.0)	0.858
MI	22(34.4)	21(33.3)	0.821
Hypertension	34(53.1)	32(50.8)	0.702
Diabetes	26(40.6)	28(44.4)	0.663
β -blockers	45(70.3)	43(68.3)	0.801
ACEIs	37(57.8)	35(55.6)	0.797
Anti-Statin	44(68.8)	42(66.7)	0.802
Anti-Diabetes	26(40.6)	28(44.4)	0.663
Smoke	10(15.6)	11(17.5)	0.781

Abbreviations: ACEIs, angiotensin converting enzyme inhibitors; Anti-Diabetes, administrating hypoglycemic agents to control hyperglycemia; Anti-Statin, administrating statins to control hyper-lipemia; BMI, body mass index; DBP, diastolic blood pressure; FBG, fasting blood-glucose; LDL, low density lipoprotein; SBP, systolic blood pressure; WC, waistline; MI, myocardial infarction

3.2. Control ratio of cardiovascular risk factors

Effective control ratio of risk factors of CHD at 6 months and 12 months between two groups were respectively compared [**Table-3, Figure-1**]. At 6 months after their discharge from the hospital, post-PCI patients in the two groups had increased control ratio of cardiovascular risk factors. Furthermore, patients in the comprehensive education group, as compared with the ordinary education group, had significant higher control ratio of certain risk factors (SBP: 89.1% vs 69.8%, $p=0.007$; WC 42.2% vs 15.9%, $p=0.001$; respectively).

Twelve months after PCI, patients in the comprehensive education group had much higher control ratio of all risk factors, compared with patients in the ordinary education group (SBP: 100% vs 69.8%, $p<0.001$; DBP: 98.4% vs 61.9%, $p<0.001$; LDL: 85.9% vs 41.3%, $p<0.001$; BMI: 90.6% vs 74.6%, $p=0.017$; WC: 68.8% vs 22.2%, $p<0.001$; Smoke: 92.2% vs 71.4%, $p=0.002$; Exercise: 21.9% vs 6.3%, $p=0.012$; respectively). However, the control ratio of risk factors in the ordinary education group at 12-month cutoff date became similar to those at the date of discharge.

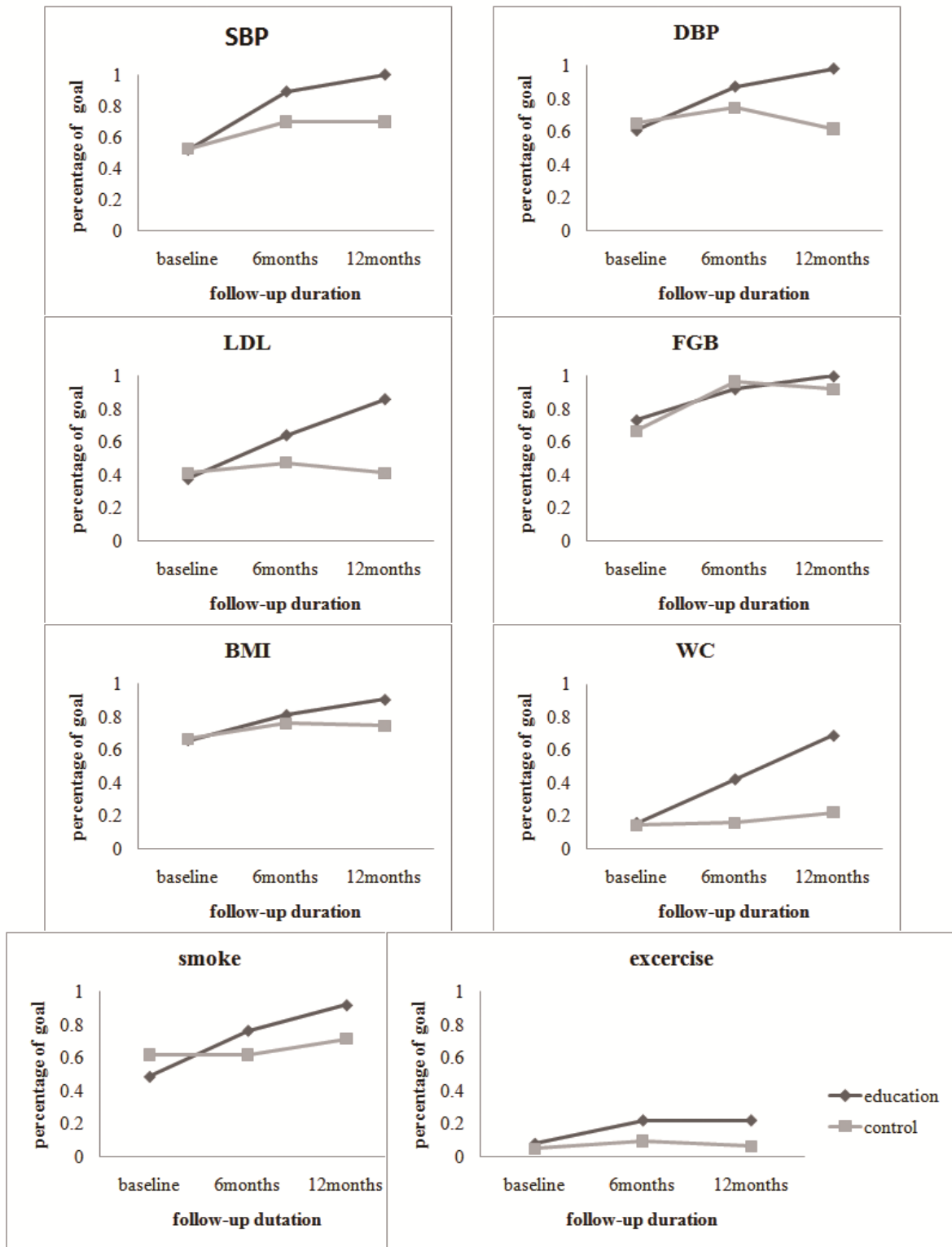


Fig: 1. Comparisons of goals of CHD risk factors between comprehensive and ordinary health education groups at 6 months or 12 months after PCI.

Abbreviations: BMI, body mass index; DBP, diastolic blood pressure; FGB, fasting blood-glucose; LDL, low density lipoprotein; SBP, systolic blood pressure; WC, waistline

3.3. Reduction of cardiovascular risk factors

After discharge from hospital, the cardiovascular risk factors were reduced in both groups [Table-3, Figure- 2]. At 6-month cutoff date, except blood pressure and blood glucose, the reductions of LDL, BMI and WC among patients in the comprehensive education group were significantly more than ordinary education group (LDL: 13.81±1.64 vs 8.45±1.17, p=0.009; BMI: 0.81±0.01 vs 0.28±0.02, p<0.001; WC: 3.17±0.16

vs 0.50±0.05, p<0.001; respectively). At 12-months cutoff date, the reductions of blood pressure and blood glucose in comprehensive education group were also significantly more than ordinary education group (SBP: 11.94±0.99 vs 3.14±0.75, p<0.001; DBP: 7.39±1.02 vs 0.98±0.50, p<0.001; LDL: 23.07±2.10 vs 5.05±0.95, p<0.001; FBG: 13.84±2.37 vs 5.61±1.21, p=0.003; BMI: 1.57±0.01 vs 0.39±0.02, p<0.001; WC: 5.02±0.22 vs 0.93±0.11, p<0.001; respectively).

Table: 3. Comparisons of reductions and goals of CHD risk factors between comprehensive and ordinary health education groups at 6 months or 12 months after PCI

	6 months						12 months					
	Reduction Mean (SE)			Goal N (%)			Reduction Mean (SE)			Goal N (%)		
	Comp	Ordinary	p	Comp	Ordinary	p	Comp	Ordinary	p	Comp	Ordinary	p
SBP	-7.28(0.97)	-5.57(0.80)	0.178	57(89.1)	44(69.8)	0.007	-11.94(0.99)	-3.14(0.75)	<0.001	64(100)	44(69.8)	<0.001
DBP	-4.22(0.99)	-2.78(0.62)	0.221	56(87.5)	47(74.6)	0.019	-7.39(1.02)	-0.98(0.50)	<0.001	63(98.4)	39(61.9)	<0.001
LDL	-13.81(1.64)	-8.45(1.17)	0.009	41(64.1)	30(47.6)	0.062	-23.07(2.10)	-5.05(0.95)	<0.001	55(85.9)	26(41.3)	<0.001
FBG	-9.74(2.14)	-7.06(1.33)	0.291	59(92.2)	61(96.8)	0.252	-13.84(2.37)	-5.61(1.21)	0.003	64(100)	58(92.1)	0.021
BMI	-0.81(0.01)	-0.28(0.02)	<0.001	52(81.2)	48(76.2)	0.486	-1.57(0.01)	-0.39(0.02)	<0.001	58(90.6)	47(74.6)	0.017
WC	-3.17(0.16)	-0.50(0.05)	<0.001	27(42.2)	10(15.9)	0.001	-5.02(0.22)	-0.93(0.11)	<0.001	44(68.8)	14(22.2)	<0.001
Smoke	--	--	--	49(76.6)	39(61.9)	0.073	--	--	--	59(92.2)	45(71.4)	0.002
Exercise	--	--	--	14(21.9)	6(9.5)	0.056	--	--	--	14(21.9)	4(6.3)	0.012

Abbreviations: BMI, body mass index; DBP, diastolic blood pressure; FGB, fasting blood-glucose; LDL, low density lipoprotein; SBP, systolic blood pressure; WC, waistline; comp, comprehensive.

[IV] DISCUSSION

Presently, the intervention of health education has focused on not only providing health information but also monitoring implementation of lifestyle change. And it is obviously beneficial for convertible risk factors management [16]. In developed countries, the post-PCI patients mostly voluntarily choose to be involved in cardiac rehabilitation programs. As a result, the CHD risk factors are minimized; meanwhile morbidity and mortality are reduced [2]. Current strategies for achieving recommended target risk factor levels include frequent follow-up, intensive diet changes, individualized and group exercise, coaching, group

meetings, education on lifestyle modification and behavior change, and formal cardiac rehabilitation programs [16]. In China, such strategies are not widely spread. Furthermore, many post-PCI patients experience immediate symptomatic relief and express the belief that the procedure has cured them [17-21]. They are less likely than other cardiac patients to initiate and maintain behavior changes. As a result, the ordinary health education, including only nominated cardiac rehabilitation advised by cardiologist, specialist nurses or general practitioner, may have less improved outcomes in health behaviors, quality of life or psychosocial wellbeing.

The present study demonstrated that the comprehensive health education program had more improved outcomes in CHD risk factors, health behaviors and quality of life than ordinary health program. And the superiority was much more significant in the long term (12 months after PCI). Nevertheless, among patients with ordinary health education program the implement of lifestyle change aimed at risk factors was unchanged or even reversed at 12 months after PCI compared with 6 months. It was evident that without comprehensive health program, ordinary heart disease information or education offered by cardiologist or specialist nurse cannot guarantee the implementation of therapeutic lifestyle change. Baseline data showed patients after PCI have limited cardiac related knowledge and poor control status of CHD risk factors. If post-PCI patients can attend the comprehensive health education program, they will obtain enough heart disease information and behavioral skills to adopt healthier lifestyles and as a result, contribute to a major reduction of the re-hospitalize and mortality rates. The services of the comprehensive health program include centralized training and regular telephone follow-ups aiming to develop and implement an education, counseling and behavioral skill-building program.

4.1. The effect of intervention on CHD risk factors

At 6 months cut-off day after PCI, no significant difference was found in blood pressure control between comprehensive and ordinary health education group. It was attributed to widespread knowledge of BP controlling. In the ordinary health education group, educators (especially the nurse) emphasized the importance of BP control. The patients had strong willingness to control blood pressure and good adherence. Hence BP was controlled in appropriate levels. But at one year after PCI, the effect of intervention on BP in ordinary education group was inferior to comprehensive group. It demonstrated that the management of hypertension under comprehensive health education was steady and not rebounded in the long run.

Controlling of blood glucose is necessary to Coronary heart disease [6]. Although no difference on the effective control ratio of blood glucose between two groups was detected, the reduction of blood glucose was lower in comprehensive education group than ordinary group. That reflected either comprehensive health education or routine health education has a good effect on blood glucose control.

To keep LDL-C level in a normal range, patients in comprehensive education group were advised to take health diet, do proper exercise, control bodyweight, and take stains. To control bodyweight and modify abdominal obesity, BMI and WC were evaluated at each time when followed up. And patients were encouraged to take physical exercise (low to moderate intensity exercise) to keep or lose weight.

Quitting smoking or drinking is a gradual process which is easily repeated. When necessary, drug substitution therapy can be

induced into cessation process. Furthermore, smoking and drinking is psycho-social problems. In addition to nicotine and alcohol addiction, patients aged less than 60 years should be pay special attention to. They have to face social interaction, entertainment, heavy social responsibility, and psychological stress. So they are difficult to refrain from smoking and drinking.

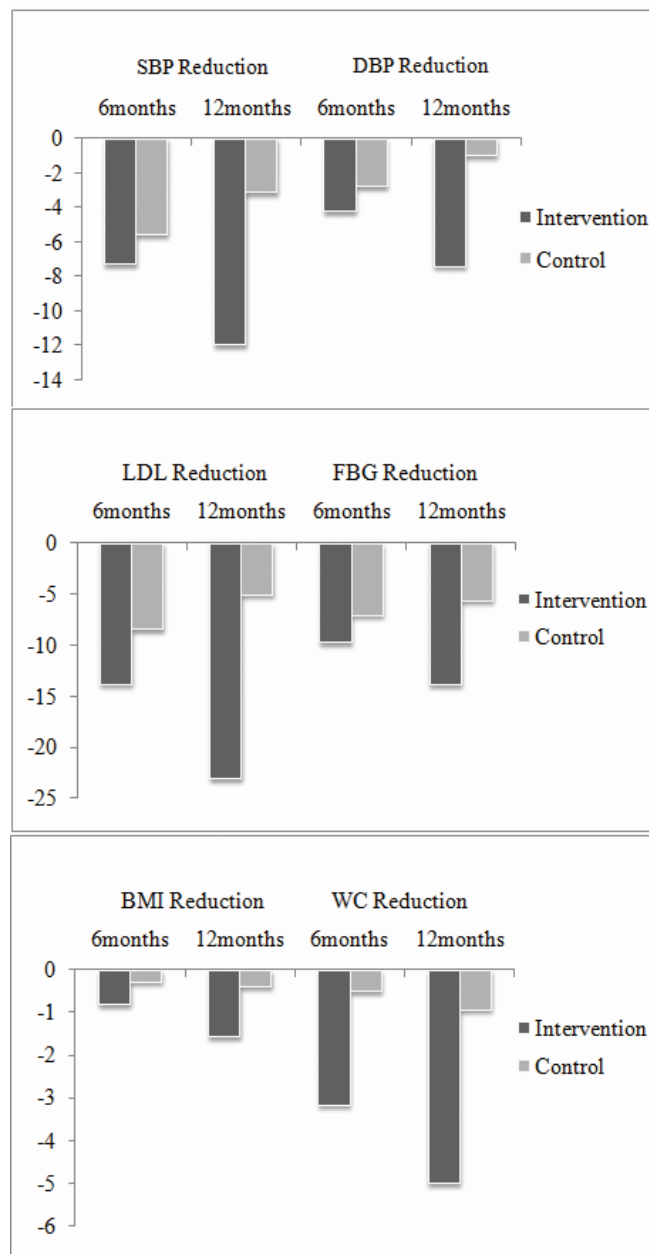


Fig: 2. Comparisons of reductions of CHD risk factors between comprehensive and ordinary health education groups at 6 months or 12 months after PCI.

Abbreviations: BMI, body mass index; DBP, diastolic blood pressure; FBG, fasting blood-glucose; LDL, low density lipoprotein; SBP, systolic blood pressure; WC, waistline.

4.2. The effect of centralized training

The centralized training organized by nurses, cardiologists, nutritionists and physical therapists can help the patients gain the comprehensive knowledge of rehabilitation: medicine, nutrition, and physiotherapy. Through this study, we found the lack of necessary and accurate information of heart disease would influence the effective control of the coronary heart disease risk factors. For example, the reason why post-PCI patients with diabetes mellitus have poor control of blood pressure may be they don't know the blood pressure should be controlled under 130/80mmHg; normal range of LDL-C level is 0~3.12mmol/L, but most patients don't know the goal level of LDL for post-PCI patients is less than 2.6 mmol/L. And post-PCI patients cannot understand the significance of exercise after PCI. Because of busy lifestyles, patients who are younger than 60 think daily physical activities can take the place of exercises, which is required after PCI. On the other hand, the patients who are older than 60 find that it is difficult to choose appropriate exercise intensity. The post-PCI patients need a certain exercise to promote the recovery of oxygen-poor organs. However, low intensity exercise only plays a consolation; high intensity exercise increases the load on cardiovascular system. Therefore, health information is the premise of promoting lifestyle improvement. The centralized training can provide professional and accurate health information for the patients

4.3. The effect of telephone follow-up

Comprehensive health education programs can make rehabilitation plans understandable to every patient. The plan includes medication, a healthy diet, exercise, quitting smoking, and controlled drinking. The plan is mainly achieved by lifestyle improvement. However, due to long-time bad habits, it will be difficult for patients to change their lifestyles in the short term, or continue in the long term. Lifestyle change is a long process, and a short-term health education will not be effective correcting bad lifestyles. Although the centralized training can help the patient begin a new lifestyle, it doesn't promise the new style will last for a long time [22, 23]. Long-term monitoring and guidance is required to achieve the lifestyle improvement. Thus, Regular follow-ups by telephone play an important part in long-term monitoring and guidance. It allows one to educate the patient not to adjust many styles at once, but to make specific stages in the plan, then achieving it step by step. And it can help us to find the factors which hinder the improvement of lifestyle during the various stages in rehabilitation process. Then we discuss with patients, revise the rehabilitation plan, and supervise implementation of plan. Finally, the regular follow-ups by telephone can reduce the possibility of giving up rehabilitation program or lowering the performance standards for various reasons or excuses of patients. With regards to some patients who can't persist for a long time, we should encourage their family members joining in the rehabilitation plan and help the patient accomplish plan better.

[V] CONCLUSION

The study demonstrated that the comprehensive health education program have more improved outcomes in CHD risk factors, health behaviors and quality of life than ordinary health program. And the superiority was much more significant in the long term. Central training can provide professional and accurate health information and telephone follow-up can monitoring the implement of lifestyle change. The comprehensive education program is obviously beneficial for convertible risk factors management.

AUTHOR CONTRIBUTION

† Drs Gao and Li have equally contributed to this work.

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