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Physical Exercise Intervention on Hypertension Patients

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***Abstract*—**Chronic diseases prevailed along with economic growth as well as life style changed in recent years in Taiwan. According to the governmental statistics, hypertension related disease is the tenth of death causes with 1,816 died directly from hypertension in 2010. There were more death causes amongst the top ten had been proofed that having strong association with the hypertension, such as heart diseases, cardiovascular diseases, and diabetes. Hypertension or High blood pressure is one of the major indicators for chronic diseases, and was generally perceived as the major causes of mortality. The literature generally suggested that regular physical exercise was helpful to prevent the occurrence or to ease the progress of a hypertension. This paper reported the process and outcomes in detailed of an improvement project of physical exercise intervention specific for hypertension patients. Physical information were measured before and after the project to obtain information such as weight, waistline, cholesterol (HD & LD), blood examination, as well as self-perceived health status. The intervention project involved a six-week exercise program, of which contained three times a week, 30 minutes of tutored physical exercise intervention. The project had achieved several gains in changing the subjects' behavior in terms of many important biophysical indexes. Around 20% of the participants had significantly improved their cholesterols, BMI, and changed unhealthy behaviors. Results from the project were encouraging, and would be good reference for other samples.

***Keywords*—**Intervention, biological information, hypertension patients, behavioral changes, chronic disease

I. Introduction

According to Bureau of Health Promotion , Taiwan's top ten causes of death statistics in 2010 show that hypertension is the 10th of the top ten causes of death with death toll of 1,816, or 1.3% of the total death counts [1]. The standardized mortality rate is 6.3 persons of every 100,000 populations. Other causes in the top ten are highly correlated with hypertension, such as heart disease, cerebrovascular disease, and diabetes etc. This indicated that hypertension is a major threat to the national health. Even worse is the prevalence of the hypertension is growing in recent years. Recent data shows that there are 24.9% of male and 18.2% of female that aged over 15 years old are suffering from hypertension [2]. High blood pressure or hypertension can be viewed as a chronic disease that could be easily controlled. Patients with hypertension can perform all kinds of daily activities like as a healthy people as long as the proper care was taken on a regular basis. However, the clinical findings indicated that patients who suffered from hypertension usually negligent such a disease before they visit the physicians for other diseases (and most of them were results from high blood pressure). Preventing a hypertension is nevertheless much easier and less costly than a medical treatment. The healthcare professionals generally advocated with plenty of evidences that proper and regularly physical exercises or movements are significant helpful in reducing the progress of or avoiding a hypertension. Therefore, it is important to implement health education on the hypertensive disorders to deliver the knowledge of detecting earlier enough a hypertension and taking accordingly proper physical movement to get rid of the risk or reduce the progress rate of a hypertension is important for the national health and for the quality life of the patients and their families. Purpose of this research is to examine how physical exercises could be helpful in strengthen the patients' health status.

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A. Hypertension

Consistent with the definition made by The Sixth Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC-Ⅵ) [4], the World Health Organization International Society of Hypertension (WHO-ISH) [3] suggested that for adults who are over the age of 18, and not taking any antihypertensive drugs, a hypertension refers to the systolic blood pressure greater than or equal to 140 mmHg, and / or diastolic blood pressure greater than or equal to 90 mmHg [3] . As far as the classification of hypertension concerns, WHO-ISH [3] classified the hypertension by grades whereas the JNC-VI [4] by stage. In addition, the WHO-ISH coined a term of "borderline hypertension" to refer a subgroup of people whose blood pressure near a defined hypertension. Those people that are at 140-149 mmHg of SBP or, 90-94 mmHg of DBP included in this subgroup.

The damages the hypertension may result are many. The medical experts generally advised that the hypertension directly or indirectly accounts for internal organs [5], [6], [7], cardiovascular diseases, cerebrovascular diseases [8], [9], nephropathy [10], and retinopathy [6].

Unfortunately, most diseases caused by high blood pressure have no obvious symptoms. But major death-causes diseases that caused by hypertension such as target organ damages, including cardiovascular, cerebrovascular, kidney, retina and other diseases will affect the prognosis. Hypertension is an invisible killer.

B. Physical Exercise and the Hypertension

The treatment plan for Adult Treatment Panel III (ATP III) of the National Cholesterol Education Program (NCEP) of the United States suggested an effective treatment for the metabolic syndromes. The top one approach is to reduce by weight through regular physical exercise, of which accordingly helpful for high blood pressure control and abnormal blood fat [11] [12]. Other than the help to the metabolic syndrome, physical exercises has a number of complex mechanisms that improve an individual's blood fat [13], [14] blood pressure [15], and blood sugar [15], and strengthen the antioxidant capacity [16], [17] [18], and help preventing obesity, cardiovascular disease and diabetes [19].A number of scholars have explored on how intensity exercise training in patients with hypertension and exercise training time can affect blood pressure. As Hagberg and Brown [20] and Hagberg [21] pointed out that the intensity <70% VO2max of exercise training, blood pressure decreased an average of 9.5 / 7.0 mmHg and 11.1 / 7.6 mmHg; Intensity> 70% VO2max of exercise training, blood pressure an average of 6.8 / 6.8 mmHg and 7.6 / 6.7 mmHg. The study of the duration of exercise training found 1 to 10 weeks of exercise training, blood pressure decreased by 9.5 / 7.1mmHg and 9.8 / 8.4 mmHg; 11 to 20 weeks of exercise training reduces blood pressure were 11.1 / 9.3 mmHg and 10.9 / 7.9 mmHg; 21 weeks of exercise training, blood pressure decreased by 10.9 / 9.6 mmHg and 11.1 / 9.1mmHg.

C. Physical Exercise Program for Hypertension Cases

The exercise training program in patients with hypertension, as suggested by the American College of Sports Medicine [22], the exercise prescription for hypertension sufferers could be performed as follows. (1) Movement Frequency: 3-7 times a week. (2) The exercise period: 30-60 minutes each time physical activity (work, leisure, sports). (3) The movement pattern: warm-up 5-10 minutes (single-joint movement, stretching exercises), the main movement for about 30 minutes, cool down 5-10 minutes (single-joint movement, stretching exercises), progressive high-intensity aerobic exercise, can effectively improve triglycerides, blood pressure, waist hip ratio. (4) The exercise intensity: It can be divided into mild> 50%, moderate 50-75%, strength <75% of the hypertensive patients with low-intensity 40-70% VO2max, maximum heart rate for each exercise recommended to achieve 70% Patients with high blood pressure have suggested that up to the maximum heart rate of 40-70%. (5) Movement type: appropriate use of endurance exercise training. ACSM (2000) pointed out that in hypertensive patients during exercise testing (exercise testing), should be in accordance with normal-like drugs; and observe the exercise tests with and without abnormal stress response, such as SBP> 260 mmHg, or DBP> 115 mmHg, should stop the exercise test [23]. In addition, ACSM (2000) gave warming that exercise training for patients with hypertension-related alerts, including: static if the SBP> 200 mmHg or DBP> 115 mmHg should not exercise; β blockers reduce the heart rate; α1-blockers, α2 blockers, calcium channel blockers and vasodilators, may cause post-exertion hypotension; And diuretics may cause diseases like the arrhythmias etc.

Other scholars reviewed the studies from 1980 to 1996, the exercise training in patients with hypertension reduces blood pressure were found in the 29 studies, a total of 26 took aerobic exercise training, the average intensity of exercise training is 62% VO2max (30-87 % VO2max), the average number of weeks is 18.9 weeks (4-52 weeks), the number of average weekly exercise times for the3.2 ± 0.8, SBP and DBP average of 4.7 mmHg, 3.1 mmHg.

II. Materials And Methods

This study used experimental research for the study on the effectiveness of physical exercise intervention. Study on the objects' blood pressure, physiological indices, blood tests, health behavior after six weeks regular exercising.

Objects. This research takes hypertension cases as objects. By screening the data from medical clinics, integrated screening, adult health assessment and community hypertension cases subject to the objects were (1) diagnosed by a physician for the first grade (grade 1) or second grade (grade 2) of hypertension, that SBP 140-179 mmHg or DBP 90-109 mmHg, (2) able to move freely without any assistance, and (3) no other history of coronary heart disease.

Information measured and collected. Several measures were performed to collect the information prior to and after the intervention. These are (1) self-conscious of physical condition, (2) personal information, (3) the physiological indices and blood tests, and (4) health behaviors.

III. Results

A. Basic Information on Participants

In this study, 61 samples were based on gender are shown in Table1. 27 were male 44.2% and females were 34 (55.7%); the number of age from 40-49 years old are 2 (3.3%), the number of age from50 – 64 are 19 accounted for 31.1%, The number of age from 65-69 are 13 accounted for 21.3%, and 27 people over the age of 70 accounted for 44.2%; marital status: married were 49(80.3%), widowed were 12 (19.6%); groups respectively: Minas were 29 (47.5%); Aboriginal people were 32 (52.5%); occupation soldiers, police officers or Catholic was 1 (1.6%), and worker were 8 (13.3%), 15 in agriculture, forestry, fishery, animal husbandry occupies 24.5%, housewives were 20 (32.7%), other were 17 (27.8%). Education: Illiterate people were 20 (32.7%). Primary people 28 were 45.9%, junior high school people were 10 accounted for 16.4%, there are two high school people accounted for 3.3%, college and university was one people accounted for 1.6%; monthly income $ 5000 - $10000, 45 people accounted for 3.8%; monthly income $10,001 - $ 20,000, 10 people accounted for 16.4%; monthly income $ 20,001 -$ 30,000, 5 people accounted for 8.2%; more than $ 30,001, 1 person accounted for 1.6%.

TABLE I
BASIC INFORMATION (N=61)

Variable	Group	Number	percent
Gender	Male	27	44.2%
	Female	34	55.7%
Age	40-49 years old	2	3.3%
	50-64 years old	19	31.1%
	65-69 years old	13	21.3%
	Above 70 years old	27	44.2%
Marital status	Married	49	80.3%
	Single or Widowed	12	19.6%
Origin	Hans	29	47.5%
	Aboriginal	32	52.5%
Occupation	Police	1	1.6%
	Blue collars	8	13.1%

	Primary industries	15	24.5%
	Housekeepers	20	32.7%
	Other (unemployed)	17	27.8%
Education	Illiterate	20	32.7%
	Elementary School	28	45.9%
	Junior high school	10	16.4%
	Senior high school	2	3.3%
	College or university	1	1.6%
Monthly income	$5000~10,000	45	73.8%
	$10,001~20,000	10	16.4%
	$20,001~30,000	5	8.2%
	$30,001+	1	1.6%

A. Changes of Blood Indices

It shows the effectiveness of blood test after six months of movement plan were measured before and after. Cholesterol less than 200 moved from 21.3% to 40.9%, increased 19.6%, cholesterol more than or equal to 200 , moved from 78.7% to 59.0%, reduced 19.7% ; high density lipoprotein cholesterol less than 40, moved from 24.6% to 16.4 % , decreased 8.2%; high density lipoprotein cholesterol 41-50 , moved from 59.0 to 60.6%, increased 1.6%; high density lipoprotein cholesterol less than 50 , moved from 16.4 %to 23.0%, increased 6.6%; LDL cholesterol less than 130, moved from 21.3 %to 41.0% , increased 19.7%, LDL cholesterol more than/equal to 130, moved from 78.7% to 59.0 %, reduced 19.7%.

TABLE II
CHANGES OF BLOOD INDICES

Variables		Pre-test		Post-test		Result
		N	%	N	%	
Cholesterol	< 200	13	21.3	25	40.9	+19.6%
	≧ 200	48	78.7	36	59.0	-19.7%
High-density cholesterol(HDL)	< 40	15	24.6	10	16.4	-8.2%
	<	36	59.0	37	60.6	+1.6%
	< 50	10	16.4	14	23.0	+6.6%
Low-density cholesterol (lDL)	< 130	13	21.3	25	41.0	+19.7%
	≧ 130	48	78.7	36	59.0	-19.7%

B. Changes in Physiological Indices

The index changes of the movement plan involved hypertension cases; no change in body weight was 47.5%. Decreased 0.5-1 kg was 36.1%; decreased 2 kg or more was 16.3%. Less than 80 cm in waist circumference were 13.1% to 16.3% increased 3.2% , 81-90 cm in waist circumference were 37.8 %to 59.0% increased 21.2%, greater than 90 cm in waist circumference were 49.1 %to 24.5% reduced 13.3%. BMI body mass index in less than 18 were 13.1 % to 13.1%, no change, BMI body mass index in 18-24 were 29.5 to 41.0 percent increased by 11.5%, greater than 24 from 57.3% to 45.9%, reduced 11.4%.

TABLE III
CHANGES IN PHYSIOLOGICAL INDICES

Variable		Pre-test		Post-test		Result
		N	%	N	%	
Body weight	±0	61		29	47.5	
	0.5-			22	36.1	
	≦ 2			10	16.3	
Waistline	<	8	13.1	10	16.3	+3.2%
	81-9	23	37.8	36	59.0	+21.2%
	>	30	49.1	15	24.5	-13.3%
Body mass index	<	8	13.1	8	13.1	±0%
	18-2	18	29.5	25	41.0	+11.5%
	>	35	57.3	28	45.9	-11.4%

C. Health Behavior Change

Table IV shows the change of health behavior after the movement plan involvements case, participants with smoking habit were 16.3 %to 14.8% , decreased 1.5%, participants with non-smoking habit were 75.4% to 85.2%, increased 9.8%, and participants with drinking habit were 36.1% to 32.8%, increased 3.3%. participants with drinking habit were 63.9% to 67.2%, increased 3.3%, participants with no weekly exercise were reduced 12.8% from 42.3% to 29.5%; participants exercise 1-3 times per week, increased 3,2% from 37.7% to 40.9%, participants exercise 4-6 times a week, increased by 3.3% 13.1% to 16.4%, participants exercise more than 7 times per week, increased 5.4% from 6.5 %to 13.1%.

TABLE IV
HEALTH BEHAVIOR CHANGE

Behaviors		Pre-test		Post-test		Result
		N	%	N	%	
Smoking	Y	10	16.3%	9	14.8%	-1.5%
	N	51	75.4%	52	85.2%	+9.8%
Alcoholic consumption	Y	22	36.1%	20	32.8%	+3.3%
	N	39	63.9%	41	67.2%	+3.3%
Weekly exercise frequency	Nil	26	42.3%	18	29.5%	-12.8%
	1-3	23	37.7%	25	40.9%	+3.2%
	4-6	8	13.1%	10	16.4%	+3.3%
	7+	4	6.5%	8	13.1%	+5.4%

IV. CONCLUSIONS

Hypertension caused by many reasons, in addition to genetic factors, others such as eating habits, the life pressures, race, area of residence are all important factors causing high blood pressure. Daily monitoring such as measuring blood pressure at regular intervals may help identifying hypertension early and to take earlier treatment to reduce associated diseases. The research had generally confirmed that exercise can lower blood pressure, the current research provide additional evidence from a remote area in eastern part of Taiwan. It is wise for the government to allocate sufficient resources in motivating the residents in this remote area participating regular exercise.

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