Regular Exercise and Cardiovascular Risk Factors

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Abstract

Physical inactivity has been counted as a risk factor for coronary artery disease. Regular exercise has also been reported to reduce risk of cardiovascular disease and its risk factors. We surveyed 3615 subjects for their conventional risk factors of coronary disease and for the frequency of their exercise. We found that subjects who had regular exercise were more likely to have lower triglyceride and resting heart rate. HDL cholesterol was higher in the group of subjects who had regular exercise. There was no difference in fasting plasma glucose, total cholesterol or blood pressure levels between those who had and those who did not have regular exercise.

Key word : Exercise, Risk Factors, Cardiovascular Disease, Coronary Artery Disease

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The AHA counts physical inactivity as a major risk factor for coronary artery disease (1). This is based on an established relationship between the risk of cardiovascular disease and physical inactivity, as shown by the Framingham Heart Study. As with obesity, physical inactivity contributes to several metabolic risk factors. However, it is not clear whether physical inactivity is an independent risk factor for coronary artery disease. It has been widely accepted that physical inactivity should be identified in risk assessment and an independent target for risk-reduction intervention.

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Practical recommendations to guide patients to start a safe and effective exercise program has been published[2-3].

It was suggested that 150 minutes of moderate-intensity physical activity accumulated throughout the week can improve health[4-6]. Simple walking exercise was also reported to have a beneficial effect on patients with coronary artery disease. It was also showed to have favorable effects on major risk factors for coronary artery disease such as cholesterol levels, hypertension, smoking and diabetes mellitus[7].

This study aimed to examine the crossectional relationship of regular exercise and fasting lipid, blood sugar and blood pressure levels in a healthy Thai population.

MATERIAL AND METHOD

Study populations: We interviewed and examined 3,615 employees of Shinawatra Corperation during their yearly physical check up. This number represents 90 per cent of the company's total employee number. All participants were informed about the study and given a confidential questionnaire one week before being examined by cardiologists. The study was approved by the ethical committee of Siriraj Hospital. Blood samples for plasma lipids and glucose levels were taken on the same morning of physical examination after at least 12 hours of fasting. It was immediately mixed with 1.5 mg of EDTA and immediately centrifuged. Plasma for lipids and glucose analysis was stored at 4°C until being analyzed. The analysis was done within 2 hours after collection.

Participants were asked to complete the questionnaire by themselves at home. This included questions on general health, behavior and method and frequency of their exercise and physical activity.

Blood pressure was measured in the right arm with subjects in a sitting position. The average of at least two measurements to the nearest 2 mmHg using a mercury sphygmomanometer was recorded and used in all analyses. The third measurement was done if the first and second readings showed a difference greater than 10 mmHg.

Laboratory procedure: Plasma levels of total cholesterol and triglyceride were measured by enzymatic techniques (Roche Diagnostics, Switzerland). High density lipoprotein (HDL) cholesterol was measured by dextran sulfate-magnesium precipitation followed by enzymatic determination of cholesterol[8-10]. The plasma glucose was determined by the glucose oxidase method. The level of low density lipoprotein (LDL) cholesterol was derived from the Friedewald calculation.

Definitions

Physical activity: Information of physical activity was retrieved from the questionnaire. Subjects in the group of regular adequate exercise were those who exercised for a duration of at least 20 minutes more than three times per week. The regular inadequate exercise group consisted of those who exercised regularly for 10-20 minutes two to three times per week, or those who exercised more than 20 minutes only two to three times per week. Persons who exercised less than 10 minutes each time, or less than twice a week, were considered not having regular exercise.

Risk factors of coronary heart disease: Hypertension is defined as systolic blood pressure higher than or equal to 140 mmHg, or diastolic blood pressure above or equal to 90 mmHg. Persons with abnormal glucose status were those with fasting plasma glucose more than, or equal to, 100 mg/dL. Normal levels for fasting total cholesterol, LDL cholesterol, HDL cholesterol, and triglyceride used in our calculation were 240 mg/dl, 160 mg/dl, 35 mg/dl and 200 mg/dl respectively.

Statistical analysis

Data entries were done separately by 2 typists and any discrepancy of the data was rechecked and corrected if possible. All incorrect data were excluded for analysis. All measured variables are presented as mean ± SD, and categorical variables are presented by frequency and percentage. Differences between groups are assessed by using chi-square, *t*-test or ANOVA where appropriate. Multivariate analysis of covariance (ANCOVA) is applied to adjust the effect of some risk factors. A p-value less than 0.05 is considered to be significant.

RESULTS

From 3,615 participants, data completion of all categories was around 99 per cent (Table 1). There were more females than males. The mean age of the male group was significantly higher than the female group (31.2 ± 6.6 and 29.3 ± 4.9 years old,

Table 1. Demographic information and completeness of data of subjects who had regular exercise (adequate and inadequate) and no regular exercise.

	No Regular Exercise		Regular Exercise				p-value	% Completeness
			inadequate		adequate			
		%		%		%		
N	2703		558		260			97.4
Sex - male	793	29.3	277	49.6	156	60	<0.001	97.4
- female	1910	70.7	281	50.4	104	40		
Age (yrs)	29.7 ± 5.4		30.6 ± 6.3		30.9 ± 6.2		<0.001	96.8
BMI (kg/m^2)	21.4 ± 3.5		21.8 ± 3.1		22.2 ± 3.1		<0.001	96.9
Education: - below bachelor	821	30.7	146	26.5	81	31.4	0.137	96.3
- bachelor or high or high	1853	69.3	404	73.5	177	68.6		
Income (Baht) - < 20,000	1294	48.3	252	45.3	119	46.1		
- 20,000-50,000	879	32.8	161	29.0	72	27.9	0.001	96.6
- > 50,000	505	18.9	143	25.7	67	26.0		
Often consume fastfood	537	19.9	101	18.1	45	17.3	0.43	97.3
Smoke	331	12.6	84	15.4	57	22.7	<0.001	97.5
Regular alcohol	171	6.4	49	8.8	33	12.9	<0.001	96.4
History of diabetes mellitus	17	0.6	7	1.3	2	0.8	0.136	97
History of hypertension	115	4.3	32	5.7	17	6.6	0.102	97
History of Hyperlipid	177	6.6	54	9.7	27	10.4	0.029	97

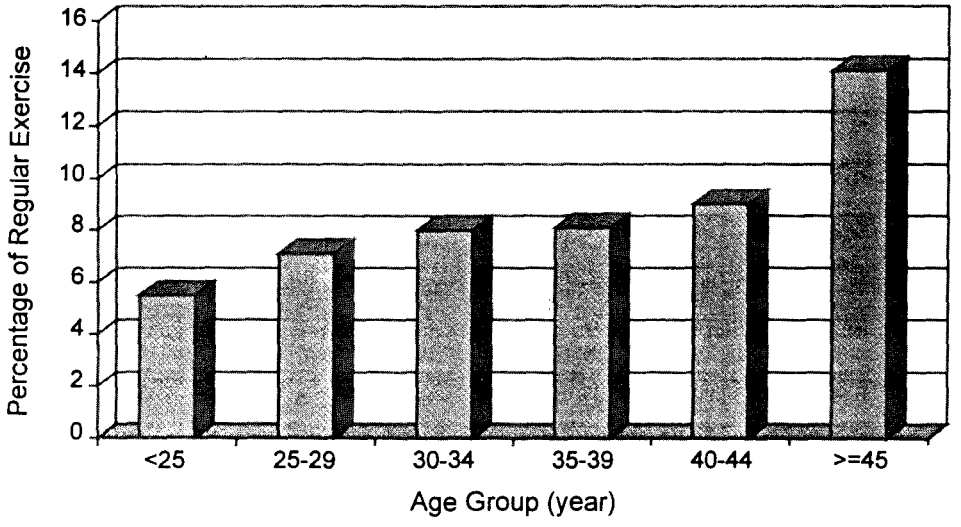

Fig. 1 Percentage of regular exercise stratified by age groups.

p <0.001). A higher percentage of males had regular exercise compared to females (35.5% and 16.7%, p=0.001). The mean body mass index (BMI) for males was 23.06 ± 3.57 kg/m^2 and for females was 20.71±2.99 kg/m^2 (p=0.01).

Fig. 1 shows that a higher percentage of older subjects had regular exercise compared to the younger subjects. Twenty-five per cent (25.6%) of people aged 30 up had regular exercise, while only 21.2 per cent of those aged below 30 exercised regularly (p=0.001).

Table 2 (a and b) shows that the regular exercise (both inadequate and adequate groups) group has lower average resting heart rate and higher blood pressure and triglyceride levels. However, after being adjusted by age, sex and BMI the regular exercise groups appeared to have lower mean triglyceride and higher HDL cholesterol levels. The adjusted mean levels of total cholesterol, LDL cholesterol, plasma glucose and diastolic and systolic blood pressures were lower in the regular exercise group but did not reach statistical significant levels. There were more subjects with high blood pressure and impaired fasting glucose in the regular exercise group, but the prevalence of abnormal total cholesterol, LDL cholesterol and triglyceride was not different between the two groups (Table 3).

Table 2. Average (mean ± SE) fasting plasma lipids and glucose, and resting heart rate and systolic and diastolic blood pressure before (a) and after (b) age, sex and BMI adjustment.

Table 2a)	No Exercise	Regular exercise	p-value
Chol (mg/dL)	200 ± 0.7	201.9 ± 1.3	0.210
TG (mg/dL)	90.2 ± 1.2	95.0 ± 2.1	0.040
LDL (mg/dL)	123.6 ± 0.6	125.5 ± 1.2	0.130
HDL (mg/dL)	58.4 ± 0.3	57.4 ± 0.5	0.070
FPG (mg/dL)	89.4 ± 0.2	90.0 ± 0.4	0.160
SBP (mmHg)	112.9 ± 0.2	115.1 ± 0.5	<0.001
DBP (mmHg)	75.3 ± 0.2	76.8 ± 0.3	<0.001
HR (beat/min)	78.8 ± 0.2	76.6 ± 0.3	<0.001
Table 2b)	**No Exercise**	**Regular exercise**	**p-value**
Chol (mg/dL)	201.3 ± 0.7	200.4 ± 1.2	0.54
TG (mg/dL)	97.3 ± 1.1	91.4 ± 1.9	0.006
LDL (mg/dL)	125.1 ± 0.7	124.1 ± 1.1	0.44
HDL (mg/dL)	56.7 ± 0.3	58.1 ± 0.5	0.01
FPG (mg/dL)	90.2 ± 0.2	89.5 ± 0.4	0.16
SBP (mmHg)	114.5 ± 0.2	114.2 ± 0.4	0.54
DBP (mmHg)	76.4 ± 0.2	76.1 ± 0.3	0.36
HR (beat/min)	78.1± 0.2	76.8 ± 0.3	0.001

Abbreviation: Chol = total cholesterol, TG =- triglyceride, LDL = LDL- cholesterol, HDL = HDL- cholesterol, SBP = systolic blood pressure, DBP = diastolic blood pressure, HR = resting heart rate

Table 3. Number of subjects with abnormal lipids, glucose levels and hypertension.

	Regular exercise				p-value
	no		yes		
		%		%	
Chol > 240 mg/dL	371	13.8	115	14.2	0.83
LDL > 160 mg/dL	345	12.9	113	14.0	0.45
HDL < 35 mg/dL	253	9.4	56	6.9	0.03
TG > 200 mg/dL	130	4.8	38	4.7	0.93
FPG > 110 mg/dL	59	2.2	29	3.6	0.039
HTN	187	6.9	75	9.2	0.04

Abbreviation: Chol = total cholesterol, LDL = LDL cholesterol, HDL = HDL cholesterol, TG = triglyceride, FPG = fasting plasma glucose, HTN = hypertension

DISCUSSION

This study demonstrated that regular exercise for a duration of 10-20 minutes or more, and 2-3 times or more per week, was associated with lower levels of triglyceride and higher HDL-cholesterol. This confirmed the benefit of exercise previously reported[11]. However, our results only confirmed a crossectional relationship of exercise and the risk factors. The benefit of regular exercise in our population may be confounded by higher level health concerns in people who exercised regularly. On the other hand, our population had a higher proportion of males who had regular exercise compared to females. The higher blood pressure and body mass index in the regular exercise groups may be a result of male subjects being present in this group, while the younger female subjects did not have regular exercise. Further more, we also demonstrated that older subjects were more likely to have regular exercise compared to the younger age groups. This could be a result of higher level of health concern in older age group. Because of these baseline differences, we could not demonstrate any obvious benefit of regular exercise on cardiovascular risk factors. After all values were adjusted by age, sex and body mass index, we only found that regular exercise was associated with higher HDL cholesterol, lower triglyceride and resting heart rate.

Further long term study is needed to observe the effect of regular exercise on risk factors of coronary artery disease as well as the risk of coronary artery disease.

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การออกกำลังกายและปัจจัยเสี่ยงของโรคหัวใจและหลอดเลือด

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การออกกำลังกายสม่ำเสมอสามารถลดอัตราเสี่ยงของโรคหัวใจ และมีความสัมพันธ์กับความเสี่ยงของโรคหลอดเลือดหัวใจ การศึกษานี้มีจุดประสงค์เพื่อดูความสัมพันธ์ทาง crossection ระหว่าง การออกกำลังกายสม่ำเสมอ กับปัจจัยเสี่ยงของโรคหลอดเลือดหัวใจ

การศึกษาทำในประชากร 3615 คน พบว่าผู้ที่มีการออกกำลังกายสม่ำเสมอจะมีอัตราความเสี่ยงของปัจจัยเสี่ยงของโรคหลอดเลือดหัวใจบางชนิดดีกว่า โดยระดับ triglyceride จะต่ำ และ HDL cholesterol จะสูง เมื่อเทียบกลุ่มที่ออกกำลังกายสม่ำเสมอกับกลุ่มที่ไม่ได้ออกกำลังกายสม่ำเสมอ ส่วนค่าเฉลี่ยความดันโลหิต, total cholesterol และ LDL cholesterol ไม่แตกต่างกันนัก

สรุปการออกกำลังกายสม่ำเสมอมีความสัมพันธ์กับปัจจัยเสี่ยงของโรคหลอดเลือดหัวใจตีบโดยที่ผู้ที่ออกกำลังกายสม่ำเสมอเพียงเล็กน้อยก็มีโอกาสที่ทำให้ปัจจัยเสี่ยงบางชนิดดีขึ้น

คำสำคัญ : การออกกำลังกาย, โรคหัวใจและหลอดเลือด, โรคหลอดเลือดหัวใจโคโรนารีย์

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