# A 5-year Prospective Study of Conventional Risk Factors of Coronary Artery Disease in Shinawatra Employees : A Preliminary Prevalence Survey of 3,615 Employees

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**Abstract**

We conducted a prevalence survey of conventional risk factors of coronary artery disease in 3,615 Shinawatra employees and we planned to prospectively follow up this population to determine the impact of the risk factors in the development of coronary disease. The prevalence of hypertension, diabetes mellitus, hyperlipidemia, obesity, physical inactivity and smoking were 7.4 per cent, 1.4 per cent, 21.1 per cent, 13.9 per cent, 76.3 per cent and 16.3 per cent respectively. The awareness of hypertension, diabetes mellitus and hyperlipidemia were 42.2 per cent, 78 per cent and 32.9 per cent respectively. The prevalence of the risk factors was more common in males and increased with increasing age. Dependent variables which were associated with hypertension included : excessive weight; male sex; increasing age; hypercholesterolemia and diabetes mellitus. Variables which were associated with diabetes mellitus were hypertriglyceridemia, hypertension, male sex, increasing age and excessive weight.. Variables which were associated with hypercholesterolemia were hypertriglyceridemia, high HDL-cholesterol, increasing age, excessive weight and hematocrit level while overweight, hypercholesterolemia, low HDL-cholesterol, smoking, hematocrit level, low income and increasing age were associated with hypertriglyceridemia. Excessive weight was associated with hypertriglyceridemia, low HDL-Cholesterol, presence of hypertension, hypercholesterolemia, diabetes mellitus, increasing age and low education.

**Key word** : Risk Factors, Coronary Artery Disease

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## BACKGROUND AND RATIONALE

During the past 30 years, significant declines in cardiovascular disease (CVD) mortality have been experienced in the west and rapid increases in CVD morbidity and mortality have been experienced in developing countries. Over sixty per cent of mortality from CVD (approximate 10.6 million deaths in 1990) occurs in these countries and in Eastern Europe. CVD is the major contributor to the burden of premature mortality and morbidity, and accounted for 85 million disability-adjusted life years (DALYS)[1]. By the year 2020, CVD will still be the leading cause of mortality and disability. The DALY attributed to CVD will rise to about 140-160 million, with about 80 per cent of the burden in developing countries[2]. This expected increase in CVD reflects the change currently experienced in developing countries following those experienced previously in the west. A global epidemic of CVD is anticipated with its greatest impact among those in the lower social class[3]. Therefore, effective CVD prevention requires a global and broad based societal strategy, which in turn requires an understanding of known and putative CVD risk factors, and their associated risks in different ethnic groups, and geographic regions. In Thailand, there are several studies concerning the prevalence of risk factors in different populations. A study in Thailand showed that there was no corrrelation between cholesterol level and mortality[4], however, there is no study done prospectively to determine the impact of various risk factors to the incidence of coronary disease. There was also no study concerning new risk factors e.g. Lp(a), homocystinuria and a presence of chlamydial infection. The purpose of our study is to determine the risk factors, both conventional and new in Shinawatra employees and to follow this population prospectively to determine the contribution of these factors and help plan the preventive strategies of coronary disease in Thailand.

## MATERIAL AND METHOD

A cluster sampling survey was performed in Shinawatra employees, which were relatively young, highly educated and have high socioeconomic status. A self administered questionnaire concerning demographic, education, family income, presence of heart disease and risk factors, physical activity, stress, alcoholic consumption and angina history using the Rose and Blackburn questionnaire was conducted.

Standing height was measured with the subject in bare feet, back square against the wall and eyes looking straight ahead and weight was measured in undergarments using a balanced scale to the nearest 200 grams. The scale was standardized to 0 before each use. Waist and hip circumference was performed to the nearest 0.1 cm using a non-stretchable standard tape measure attached to a spring balance exerting a force of 750 grams (Ohaus tape). The waist circumference was taken over the unclothed abdomen at the smallest diameter between the costal margin and the iliac crest. The tape measure was kept horizontal and just tight enough to allow the little finger to be inserted between the tape and the subject's skin. The hip circumference was taken at the level of greater trochanters (usually the widest diameter around the buttocks).

The blood pressure was done using a standard mercury sphygmomanometer twice on the right arm, and the exact values were recorded to the nearest 2 mmHg. A third measurement would be performed if there was 10 mmHg, or more, difference between the first two readings and the average of the two closest values was used for the analysis. The correlation coefficients between the two measurements of systolic and diastolic blood pressure were 0.94 and 0.89 respectively.

Blood samples were taken after 10-12 hours fasting and were processed within 4 hours and serum stored in –70' C for further analysis. The DNA material was extracted from the WBC and stored for further analysis. The laboratory performance included a complete blood count, fasting blood sugar, serum lipids (cholesterol, triglycerides and HDL-cholesterol), serum creatinine and uric acid using Hitachi 717 and 917 automation system. The coefficients of variation between run and within run were performed every day and was less than 5 per cent. The external quality control was performed every 4 weeks by joining the QAP (quality assurance program) from Roche Diagnostics. The coefficients of variation for serum cholesterol, triglycerides and HDL-cholesterol were 2.29 per cent, 3.09 per cent and 3.45 per cent respectively (see Table 1). Twelve lead electrocardiographies were performed in those subjects aged more than 30 years old using the HP- playwriter Xli with the autoanalyzer and was confirmed by one of the investigators.

**Table 1. Laboratory methods and quality control of the laboratory.**

| | Method | External CV (%) | Internal CV (%) |
|---|---|---|---|
| Creatinine | Kinetic Colorimetric | 2.40 | 2.04 |
| Glucose | Glucose oxidase | 2.38 | 1.36 |
| Cholesterol | CHOD-PAP | 2.29 | 1.59 |
| Triglyceride | GPO-PAP | 3.09 | 2.02 |
| HDL-Cholesterol | CHOD-PAP | 3.45 | 3.25 |
| Lp(a) | Immunoturbidimetric | 4.35 | 3.35 |
| Homocysteine | FPIA | 3.58 | 2.98 |
| *C. pneumoniae* | Automated ELISA | 4.85 | 3.65 |

**Table 2. Characteristics of the study population.**

| | Mean | S.D. | Range |
|---|---|---|---|
| Age (yrs) | 30.0 | 5.6 | 18-58 |
| BMI (kg/m$^2$) | 21.5 | 3.4 | 13.7-45.1 |
| Systolic BP (mmHg) | 113.4 | 12.5 | 78-188 |
| Diastolic BP (mmHg) | 75.6 | 9.4 | 35-139 |
| Cholesterol (mg/dL) | 200.5 | 36.6 | 98-377 |
| Triglycerides (mg/dL) | 91.5 | 60.0 | 21-817 |
| HDL-Chol (mg/dL) | 58.1 | 14.7 | 13-127 |
| Male : Female | 34.3% : 65.7% | | |

The data was recorded twice in the Dbase Foxpro II by two separate research assistants. If there was any discrepancy between the two values, the data would be checked and corrected. A telephone call would be made directly to the subject to obtain any missing data from the questionnaires. The completeness of our data ranged from 99.0-99.9 per cent The statistical analysis was performed by a biostatistician using the SPSS for windows. Univariate, linear regression and logistic regression were applied where appropriate.

## RESULTS

A total of 3,615 subjects were studied, 1,250 (34.3%) were male and 2,365 (65.7%) were female. The mean age was 30.0 ± 5.6 years (range 18-58). Most of the population had a family income of more than 10,000 baht/ month and graduated from a university or higher. A history of smoking was more common in males. The prevalence of current frequent smoking and social smoking in males was 18.5 per cent, 13.1 per cent while the prevalence in females was 1.6 per cent and 6.5 per cent respectively. The characteristics of the population are shown in Table 2.

The mean body mass index was 21.5 ± 3.4 kg/m$^2$ (range 13.7-45.1). The mean systolic and diastolic blood pressures were 113.4 ± 12.5 (range 78-188) and 75.6 ± 9.4 (range 35-139) mmHg respectively. The mean cholesterol was 200.5 ± 36.6 mg/dL (range 98-377) while the mean of triglycerides and HDL-cholesterol were 91.5 ± 60.0 (range 21-817) and 58.1 ± 14.7 (range 13-127) mg/dL respectively.

The prevalence of hypertension by measurement was 15.5 per cent in males and 3.2 per cent in females and the overall prevalence of hypertension by measurement was 7.4 per cent. The age- specific prevalence of hypertension, diabetes mellitus, hyperlipidemia, smoking, obesity, stress, physical inactivity are shown in Fig. 1, 2. The prevalence of mild, moderate and severe hypertension was 5.7 per cent, 1.3 per cent and 0.4 per cent respectively (11.5%, 3.0% and 1.0% in males and 2.7%, 0.4%, 0.1% in females). The prevalence of hypertension (by history only) was 5.3 per cent in males and 2.1 per cent in females. The overall prevalence of hypertension (by history and measurement) was 10.4 per cent (18.8% in males and 5.9% in females). The awareness of hypertension in

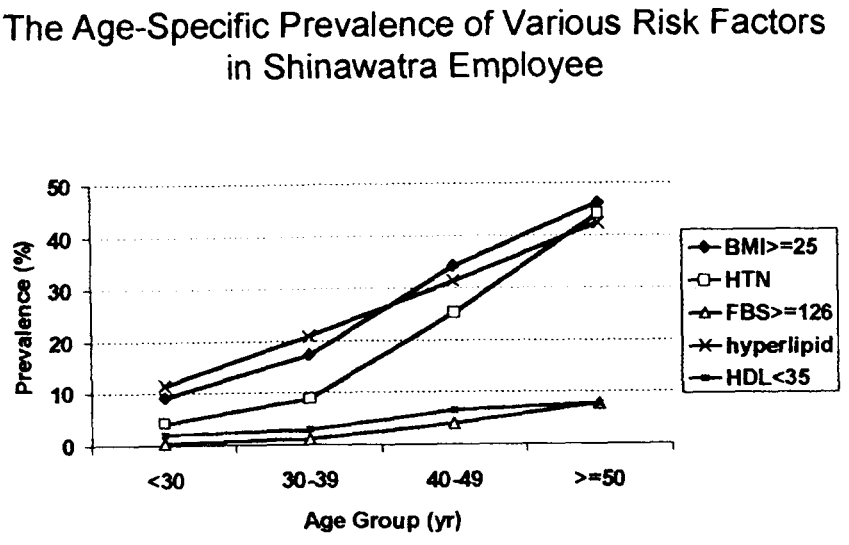


**Fig. 1.** Age specific prevalence of overweight, hypertension, diabetes mellitus and lipids abnormalities.

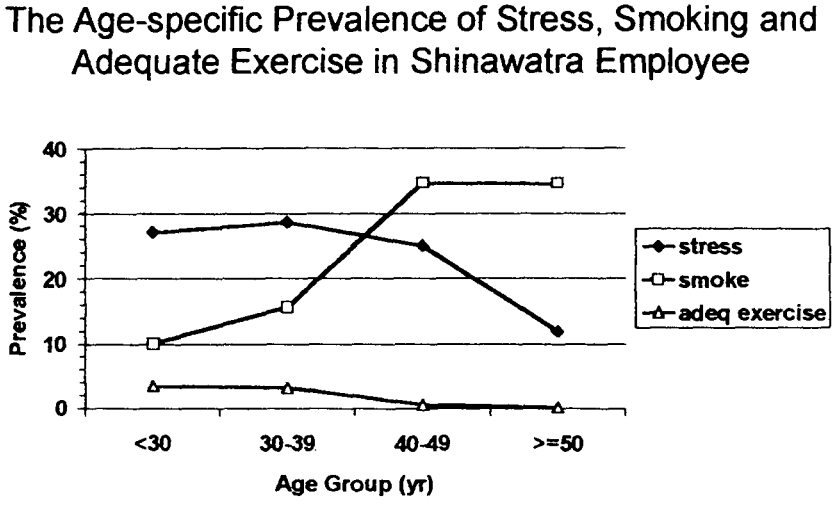


**Fig. 2.** Age specific prevalence of smoking, stress and physical activity.

our population was 42.2 per cent, 8.3 per cent received medical treatment and only 29.0 per cent of those who received treatment had adequate blood pressure at the time of survey.

The prevalence of diabetes mellitus (fasting blood sugar => 126 mg/dL) was 0.8 per cent, the prevalence in males was 2.2 per cent and was much higher than in females (0.1%). Thirty nine employees (0.8%) reported that they had a history of diabetes mellitus and the history of diabetes was found in 1.4 per cent of males and 0.6 per cent in females. The awareness of diabetes mellitus was 78 per cent, 16 per cent received hypoglycemic agents or insulin treatment, but only 37.5 per cent of those who received treatment had normal blood sugar at the time of survey.

The prevalence of hyperlipidemia (fasting serum cholesterol more than 239 mg/dL and / or serum triglyceride more than 200 mg/dL) was 16.6% (24.9% in males and 12.2% in females). By history, 7.3 per cent reported that they had hyperlipidemia (11.5 % in males and 5.5% in females). The overall prevalence was 21.1%, 31.1% in males and 15.8% in females. Two hundred forty five out of 745 employees (32.2%) knew that they had hyperlipidemia, but only 19 received lipid lowering agents and 42.1 per cent of those who received treatment had normal blood lipids at the time of survey. The prevalence of low HDL-cholesterol was 8.9 per cent (5.6% in males and 10.7% in females).

Physical inactivity defined as lack of regular exercise 3 times a week was found in 76.3 per cent, 15.3 per cent had regular exercise 1-2 times a week and only 8.4 per cent had regular exercise 3 or more times a week. Two hundred sixty six out of 3611 employees (7.4%) had regular exercise 3 or more times a week and the duration of each exercise was more than 15 minutes. The prevalence of obesity (body mass index more than 29.9 kg/m$^2$) was 2.4 per cent and the prevalence of excessive weight (body mass index 25.0-29.9 kg/m$^2$) was 11.5 per cent. Excessive weight and obesity were more common in males (24.7% *versus* 8.3%). The prevalence of excessive weight and obesity increased with increasing age as shown in Fig. 2.

Smoking history was quite low in our population as 31.6 per cent in males and 8.1 per cent in females had a history of current smoking and the history of previous smoking was 11.3 per cent and 3.7 per cent in males and females respectively. Alcohol drinking was found in 85.1 per cent of males and 58.5 per cent of females but frequent alcohol drinking was found in only 16.5 per cent and 2.3 per cent of female respectively. Most of the alcohol consumed was whiskey and beer. The level of stress was very high at the workplace compared to the stress at home. The prevalence of moderate and severe mental and emotional stress was 82.2 per cent and 75.5 per cent at the workplace and the prevalence was 40.7 per cent and 40.9 per cent respectively at home.

The age specific prevalence of hypertension, diabetes mellitus, hyperlipidemia and obesity is shown in Fig. 1 and the prevalence of smoking, stress and adequate exercise is shown in Fig. 2.

Dependent variables which were associated with hypertension, diabetes mellitus, hyperlipidemia, obesity are shown in Table 3.

## DISCUSSION

Our study population represented a Thai population with a relatively younger age and more females than other previous studies done in Thailand[5-23]. Our population also had better educa-

**Table 3. Showed associated factors of various risk factors found in the Shinawatra survey by multiple logistic regression.**

| Hypertension | Overweight | Diabetes Mellitus | Hypercholesterolemia |
|---|---|---|---|
| Body Mass index | Hypertriglyceridemia | Hypertriglyceridemia | Hypertriglyceridemia |
| Male sex | Low HDL-Cholesterol | Hypertension | HDL-Cholesterol |
| Increasing age | Hypertension | Male sex | Increasing age |
| Hypercholesterolemia | Hypercholesterolemia | Increasing age | Overweight |
| Diabetes mellitus | Diabetes Mellitus | Overweight | Hematocrit level |
| | Increasing age | | |
| | Lower education | | |

| Hypertriglyceridemia | Low HDL-Cholesterol |
|---|---|
| Overweight | Hypertriglyceridemia |
| Hypercholesterolemia | Overweight |
| Low HDL-Cholesterol | Male sex |
| Smoking | Hypercholesterolemia |
| Hematocrit level | |
| Low family income | |
| Increasing age | |

tion and was a higher socioeconomic group. Because of their demanding job they had no time for physical activity and had more stress at the workplace. All these risk factors should increase the chance of having coronary heart disease in the future. Prospective follow up will provide interesting information concerning the impact of these risk factors in the development of coronary disease.

The prevalence of diabetes mellitus, obesity, hyperlipidemia was lower than previous studies (11) probably due to the younger age group, more females and lower body mass index in our population. The prevalence of physical inactivity was very common, although comparison with previous studies was not feasible due to different criteria for physical inactivity.

The awareness of hypertension, diabetes mellitus and hyperlipidemia in our population was relatively high(15) because it was the policy of the company that all employees have annual checkups and, because of their high education, enable them to be more health conscious than other group. However, the percentage of those who received treatment was still low. This may be due to their use of nonpharmacologic means to control their risk factors or negligence. However, the majority of those who received treatment did not have adequate control. Measures to improve the treatment, follow-up and health care availability are necessary if we would like to prevent coronary disease in this population group.

From our study, we also showed that the risk factors are interrelated as shown in Table 3. Measures to prevent the coronary disease, therefore, should not be prioritized into only one single risk factor such as hypertension or diabetes mellitus, but should be considered an approach for global lifestyle change if we would like to decrease the increasing incidence of coronary artery disease. Limitations of the study

The study population was a selected group which represented a relatively young, high socioeconomic status, high education and stressed population. We would like to follow-up the population to determine the impact of these risk factors to the development of coronary disease.

## SUMMARY

We reported the prevalence survey of conventional risk factors in Shinawatra employees. The prevalence of hypertension, diabetes mellitus, hyperlipidemia, obesity, physical inactivity, smoking were 7.4 per cent, 1.4 per cent, 21.1 per cent, 13.9 per cent, 76.3 per cent and 16.3 per cent respectively. The awareness of hypertension, diabetes mellitus and hyperlipidemia were 42.2 per cent, 78 per cent and 32.9 per cent respectively. We also analyzed the dependent variables associated with hypertension, diabetes mellitus, hyperlipidemia and obesity in our population.

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# การศึกษาแบบไปข้างหน้าระยะเวลา 5 ปีเกี่ยวกับปัจจัยเสี่ยงของโรคหลอดเลือดหัวใจในกลุ่มพนักงานบริษัทชินวัตร 3,615 ราย : ความชุกของปัจจัยเสี่ยงต่าง ๆ จากการสำรวจ

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คณะผู้วิจัยได้ทำการสำรวจปัจจัยเสี่ยงของโรคหลอดเลือดหัวใจในกลุ่มพนักงานบริษัทชินวัตรจำนวน 3615 ราย โดยใช้แบบสอบถาม การตรวจร่างกาย การตรวจเลือด พบว่ามีความดันโลหิตสูง 7.4% โรคเบาหวาน 1.4% โรคไขมันในเลือดสูง 21.1% โรคอ้วน 13.9% การไม่ออกกำลังกายสม่ำเสมอ 76.3% และสูบบุหรี่ 16.3% พนักงานที่ตรวจพบว่ามีความดันโลหิตสูง โรคเบาหวาน และไขมันในเลือดสูง มีประวัติ หรือเคยได้รับยารักษาโรคดังกล่าวคิดเป็น 42.2 % 78% และ 32.9% ตามลำดับ พบว่าปัจจัยที่พบร่วมกับโรคความดันโลหิตสูงคือภาวะอ้วนะ เฟศชาย อายุ ระดับ Cholesterol และโรคเบาหวาน ปัจจัยที่พบร่วมกับโรคเบาหวานคือระดับ triglyceride, ความดันโลหิตสูง เฟศชาย อายุและภาวะอ้วน ปัจจัยที่พบร่วมกับโรคไขมัน cholesterol ในเลือดสูงคือระดับ triglyceride ในเลือดสูง ระดับไขมัน HDL–Cholesterol สูง อายุ ภาวะอ้วนและระดับ hematocrit ในขณะที่ภาวะอ้วน ระดับ Cholesterol ในเลือดสูง ระดับ HDL– Cholesterol ต่ำ การสูบบุหรี่ ระดับ hematocrit อายุและ การมีรายได้น้อย มีความสัมฟันธ์กับระดับไขมัน triglyceride สูง โรคอ้วนมีความสัมฟันธ์กับระดับ triglyceride ในเลือดสูง ระดับ HDL–Cholesterol ต่ำ ความดันโลหิตสูง ระดับ Cholesterol ในเลือดสูง โรคเบาหวาน อายุและการศึกษา

**คำสำคัญ** : ปัจจัยเสี่ยง, โรคหลอดเลือดหัวใจ

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