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Coronary Heart Disease Risk Factors and Cardiovascular Risk in Physical Workers and Managers

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This study aimed to assess the incidence of coronary heart disease (CHD) risk factors and cardiovascular risk in physical workers and managers in Poland. There were 232 male subjects: 123 managers (48.9 ± 11.2 years old) and 109 physical workers (37.5 ± 11.1 years old). The family history of CHD was recorded and anthropometric and biochemical indices, i.e., body mass index, visceral obesity index, blood pressure, glucose, total cholesterol, fibrinogen, HDL (high density lipoprotein), LDL (low density lipoprotein) and triglycerides were measured. Cardiovascular risk was assessed with the Systematic Coronary Risk Evaluation (SCORE) table system. The factors that turned out to be the most common in the managers were obesity, hypertension, and elevated levels of blood glucose and LDL, whereas cigarette smoking, premature CHD in the family and a high level of fibrinogen were more common in physical workers. Very high cardiovascular risk was found in 35% of managers and in 16% of physical workers.

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1. INTRODUCTION

Cardiovascular diseases, among which the most common are hypertension, coronary heart disease (CHD) and stroke, are a serious problem for today's medicine. They are, beside cancer, the most serious threat to the health and life of the population of developed countries, including Poland. According to statistical data, in 2001 cardiovascular mortality accounted for almost 48% of all deaths, often premature ones, of occupationally active people [1]. The large number of people unable to work because of a chronic cardiovascular disease and its complications is another aspect of the problem.

Until 1991 cardiovascular mortality in Poland was high and rising. The year 1992 was a threshold; since that year we have observed a slow but continuous decrease in morbidity and mortality. However, Poland still ranks high in the top 10 countries with the highest cardiovascular mortality [1, 2].

Mortality among Polish men is almost twice as high as that in highly developed states of the European Union (EU). In 2001 standardized cardiovascular mortality rates for males in other EU states and in the Russian Federation were as follows: Poland 545, the EU 298, Russia 1068 (per 100000 inhabitants). The increase in the incidence of CHD in increasingly younger age groups should not be overlooked, either [1, 3].

The Framingham Heart Study (FHS), carried out since 1948 in the USA for long-term observation and assessment of risk posed by cardiovascular disease in a representative group of 5209 men and women, introduced the term risk factor [4]. According to its definition, general cardiovascular risk is the probability of cardiovascular disease or death caused by it at a given time, which follows the synergistic activity of risk factors present in a given person. Various internal and external risk factors, often subject to modification, influence the incidence of cardiovascular disease. Epidemiological studies conducted at various research centres (FHS, WOSCOPS [1], REGRES [1], HOT [1], etc.) have made it possible to identify almost 250 risk factors that increase cardiovascular risk. It has been possible to determine to what extent modification of those factors can affect the development of the disease [3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16].

Currently, the so-called SCORE (Systematic Coronary Risk Evaluation) index developed by experts from eight European scientific societies is the basic tool for quick assessment of cardiovascular risk. It considers the following data: gender, age, cigarette smoking, systolic blood pressure and the level of total cholesterol [17]. This index has been generally criticized, though, because it does not consider many significant factors that have an unquestionable influence on the incidence of cardiovascular disease, e.g., blood-glucose disorders, type 2 diabetes, obesity, visceral obesity, broadly defined lipid disorders, environmental factors, etc. [18, 19, 20, 21, 22, 23, 24].

The large studies conducted so far (FHS [4], 4S [1], LIPID [1], WOSCOPS [1], etc.) have shown that the following factors have a significant influence on the incidence of cardiovascular disease:

- life-style behaviours such as a high-calorie diet rich in unsaturated fat and cholesterol, cigarette smoking, excessive alcohol consumption, low physical activity;
- biochemical and physical factors that can be modified: a high level of low density lipoprotein (LDL), low concentration of protective high density lipoprotein (HDL), high concentration of triglycerides (TG), hypertension, obesity, diabetes;
- personal characteristics that cannot be modified: age (females over 55, males over 45), premature heart disease in the family, early stage of the disease.

In addition to those factors, the occupation and the working conditions influence the incidence of cardiovascular disease. Many reports indicate a close relationship between the type of work or specific factors that characterize working conditions and CHD [5, 6, 7, 13, 22, 23, 25, 26, 27, 28, 29]. In accordance to the latest guidelines based on the Consensus of the Editorial Board of the Polish Forum for Preventing

Cardiovascular Disease, it has been proved that increased cardiovascular risk is related to a high concentration of fine particles of dust (≤2.5 μm in diameter) [10] .

Irrespective of what cardiovascular risk factors are considered, identification of people in whom those factors are present is the basis of any assessment of individual risk. This is so because those people are prone to hypertension, CHD, myocardial infarction and stroke. The assessment of the incidence of CHD risk factors and of cardiovascular risk in physical workers and managers, in Poland, was the aim of this study.

2. METHODOLOGY AND SUBJECTS

There were 232 male subjects. They were selected in the order they reported for periodic preventive medical check-ups in enterprises in 2004–2005; 123 of them did mental work (mid-level managers in government administration), whereas the other 109 did hard physical work (with energy expenditure of 1 500–2 000 kcal).

The subjects' mean age was 48.9 years (*SD* 11.2) for managers and 37.5 (*SD* 11.1) for physical workers. During the test, BMI (body mass index), visceral obesity index (waist measurement) and blood pressure were measured, and family history was taken. Table 1 lists demographic and anthropometric data.

The levels of glucose in the blood, total cholesterol, fibrinogen, HDL, LDL and triglycerides were measured for every subject. Table 2 shows the results of those biochemical tests.

CHD risk factors and cardiovascular risk were established for all subjects. Cardiovascular risk factors were defined as follows: total cholesterol >200 mg/dl; LDL >130 mg/dl; HDL <40 mg/dl; triglycerides >150 mg/dl, glucose >110 mg/dl; BMI ≥30; waist measurement ≥102 cm, premature CHD at a young age (i.e., myocardial infarction or sudden cardiac death of father or a male first cousin under 55, or of mother or a female first cousin under 65) as well as cigarette smoking and hypertension.

Cardiovascular risk was assessed with SCORE tables; the risk of cardiovascular death in the next 10 years was thus be estimated. The SCORE system considers five main risk factors: age, gender, systolic blood pressure, the level of cholesterol and cigarette smoking.

Statistica 6.0 was used to analyse the results. Contingency analysis (χ^2) and correspondence analysis were used to establish the relationship between risk factors and occupational groups.

3. RESULTS

The incidence of 11 CHD risk factors by occupational group is presented in Table 3. An

TABLE 1. Demographic and Anthropometric Data of the Subjects

Parameters		Managers	Physical Workers	Total
Age (years)	*M*	48.94	45.66	45.66
	SD	11.2	12.1	12.1
	range	26–76	25–76	25–76
Body mass index	*M*	27.4	27.2	27.2
	SD	5.6	6.5	6.5
	range	19.8–74.9	17.9–85.7	17.9–85.7
Waist measurement (cm)	*M*	95.2	91.1	91.1
	SD	8.7	11.8	11.8
	range	75–130	63–130	63–130

Notes. Managers: *N* = 123, physical workers: *N* = 109, total: *N* = 232.

TABLE 2. Results of Biochemical Tests

Factors		Managers	Physical Workers	Total
Glucose (mg/dl)	*M*	93.4	95.7	90.6
	SD	15.7	18.2	18.6
	range	59–146	70–230	59–230
Total cholesterol (mg/dl)	*M*	224.7	208.8	215.9
	SD	41.4	38.4	42.8
	range	142–370	125–312	125–375
HDL (mg/dl)	*M*	53.6	53.9	57.5
	SD	11.4	11.3	13.5
	range	32–88	35–88	32–110
LDL (mg/dl)	*M*	142.3	127.6	134.0
	SD	36.4	33.9	37.3
	range	28–253	61–227	28–270
Triglycerides (mg/dl)	*M*	143.4	146.6	124.8
	SD	74.3	101.4	80.6
	range	39–521	40–626	39–626
Fibrinogen	*M*	284.8	344.0	314.6
	SD	72.1	85.2	84.1
	range	168–559	183–643	168–643

Notes. HDL—high density lipoprotein, LDL—low density lipoprotein. Managers: $N = 123$, physical workers: $N = 109$, total: $N = 232$.

TABLE 3. Risk Factors for Coronary Heart Disease

	Managers		Physical Workers		Total	
Risk Factors	***N***	**%**	***N***	**%**	***N***	**%**
Total cholesterol (>200 mg/dl)	82	66.7	61	56.0	143	61.6
LDL (>130 mg/dl)	80	65.0	47	43.1	127	54.7
HDL (<40 mg/dl)	10	8.1	6	5.5	16	6.9
Triglycerides (>150 mg/dl)	47	38.2	40	36.7	87	37.5
Fibrinogen	10	8.0	20	18.3	30	13
Glucose (>110 mg/dl)	13	10.6	5	4.6	18	7.8
Body mass index (≥30)	24	22.0	24	19.5	48	20.1
Waist measurement (≥102 cm)	21	17.1	23	21.1	44	18.9
Premature cardiovascular disease in the family	37	30.1	20	18.3	57	24.6
Cigarette smoking	31	25.2	49	45.0	80	34.5
Hypertension	30	24.4	13	11.9	43	8.5

Notes. HDL—high density lipoprotein, LDL—low density lipoprotein. Managers: $N = 123$, physical workers: $N = 109$, total: $N = 232$.

elevated level of total cholesterol, LDL, glucose, a reduced level of HDL and hypertension were more common in managers than in physical workers; whereas an elevated level of triglycerides, general obesity, central obesity and cigarette smoking were more common in physical workers.

Contingency analysis (Pearson's χ^2) showed a statistically significant relationship between managers and the presence of the following CHD

risk factors: elevated levels of glucose (p = .016), LDL (p = .009) and fibrinogen (p = .038).

Then correspondence analysis was used to analyse the 11 CHD risk factors and the two occupational groups. On the basis of an analysis of eigenvalues, 7 out of the 11 risk factors were identified. They explain 80% inertion, i.e., the χ^2 value. An analysis of the correspondence between the identified factors and the occupational groups made it possible to identify two groupings: occupational group and risk factors. The following factors were more common in the managers: obesity, hypertension, and elevated levels of glucose and LDL. On the other hand, cigarette smoking, premature CHD in the family and the level of fibrinogen were more common in the physical workers (Figure 1).

Very high cardiovascular risk (>10%) was found in 35% of the managers, whereas high risk (5–9%) in 28%. On the other hand, in physical workers high cardiovascular risk was found in 23% and very high risk in 16% of the subjects (Table 4).

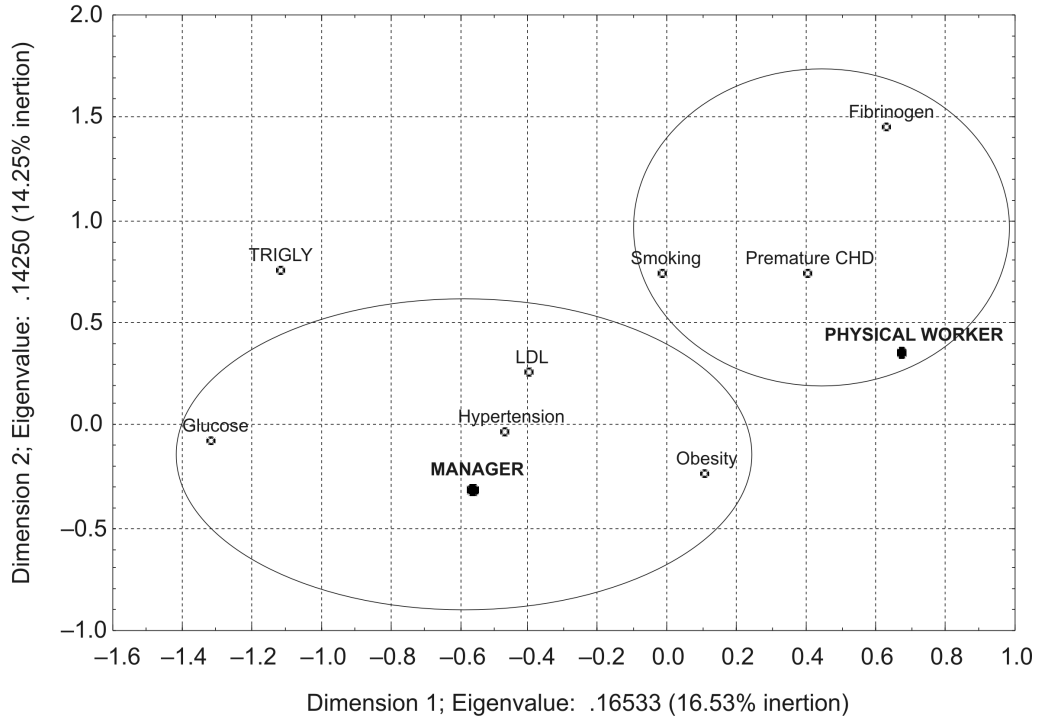

Figure 1. A map of a correspondence analysis of occupational groups and risk factors for coronary heart disease (CHD). *Notes.* LDL—low density lipoprotein, trigly—triglycerides.

TABLE 4. Cardiovascular Risk (Systematic Coronary Risk Evaluation, SCORE)

	High-Risk Cases					
Subjects	**SCORE (%)**	***N***	**%**	***M***	***SD***	**Range**
Physical workers	5–9	28	23.0	4.27	4.78	0–20
	10–20	20	16.0			
Managers	5–9	31	28.0	7.77	5.84	0–21
	10–21	38	35.0			
Total	5–9	59	25.4	4.73	5.24	0–21
	10–21	58	25.0			

Notes. SCORE: >5%—high risk, >10%—very high risk. Managers: N = 123, physical workers: N = 109, total: N = 232.

4. DISCUSSION

In Poland, on average, 467 people die of cardiovascular diseases every day. Almost a fifth of them are under 65 years old. Insufficient identification of people at risk from cardiovascular disease and sudden death is one of the causes of such high mortality.

These authors analysed the presence of risk factors in two occupational groups: managers and physical workers. Risk was assessed with one of the best methods of estimating global risk, i.e., the SCORE scale, which had been developed on the basis of the long-term Framingham study [4].

Recently it has been stressed that risk assessment that considers only the five factors from the SCORE scale leads to an underestimation of risk, especially in high-risk groups. Jurgensen has suggested changing the algorithm used for assessing risk of cardiovascular events, so that it considers factors hitherto ignored (family history, metabolic syndrome, physical activity, level of stress, kidney functions and socioeconomic status) [20]. That is why the authors of this paper extended their analysis in both groups of subjects by adding blood-glucose level measured on an empty stomach, triglycerides, fibrinogen, HDL, LDL, BMI, waist measurement and family history.

Literature data indicate unambiguously that the most common risk factors for cardiovascular disease are lipoid disorders (especially a high level of LDL), followed by hypertension and diabetes, whose level is not considered on the SCORE scale [9, 11, 23, 24, 28, 29, 30, 31, 32]. Our results confirmed this. Dyslipidemia (high total cholesterol and LDL, low HDL) was more common in managers than in physical workers; more people had an abnormal blood-glucose level and hypertension.

Obesity is a generally recognized risk factor for cardiovascular disease. Mora, Yanek, Moy, et al.'s multifactorial analysis of 827 persons, which included the SCORE index, race and BMI, showed that BMI was the strongest predictor of a coronary incident [21]. This was confirmed by Wannamethee and Sharper's 15-year prospective studies conducted in 7000 men aged 40–59 years [24]. They showed that when BMI was greater than 26, the risk of myocardial infarction, stroke and diabetes increased. In our study, both groups had BMI of over 26.

Studies conducted in recent years have shown that another index, visceral obesity, is a much better predictor than BMI. We have found that the incidence of visceral obesity was similar in both groups that were studied.

The large INTERHEART study (~30000 persons, with 15000 with one myocardial infarction) reported that the most frequent risk factors were cigarette smoking, hypertension, lipid disorders, obesity, diabetes (two of those factors are not considered in the SCORE scale) [32]. Yousufa, Hawken, Ounpuu, et al., have also found that cigarette smoking and lipid disorders were present in as many as two thirds of the patients with myocardial infarction. Among other factors, the following ones were listed: hypertension, diabetes, visceral obesity, diet poor in vegetables and fruit, sedentary life style and psychosocial stress.

Recent years have brought many reports on how, in addition to the aforementioned risk factors, socioeconomic status affects cardiovascular morbidity and mortality, especially in the presence of other risk factors [7, 9, 19, 23]. This is especially true for working-class men who do hard physical work [31]. Women in a difficult financial situation, too, are more likely to suffer from cardiovascular disease [7]. Rywik et al.'s 1990 Pol-MONIKA study indicated more frequent presence of cardiovascular risk factors, including generally higher BMI, more frequent obesity, higher heart rate and more frequent hypertension, in 35–64-year-old inhabitants of Warsaw, Poland, who belonged to lower social classes (peasant or working-class background, left school at a young age, do hard physical work) in spite of a higher level of protective HDL cholesterol in serum [8, 9].

Baum, Ortiz and Quan have suggested that the presence of risk factors at an early stage of life, i.e., in childhood, at a young age or even already during pregnancy, especially in lower social classes is related to an increased risk of cardiovascular disease. It should be stressed that

people doing jobs that involve hard physical work most often are recruited from this population [33]. Our study does not confirm this tendency, because general cardiovascular risk was lower in physical workers than in managers. This could have been so because the physical workers were younger than the managers.

A 1993 report that summarized the results of a study of the relationship between socioeconomic status and cardiovascular disease—approved by the Science Advisory Committee, American Heart Association—stated unambiguously that socioeconomic status was an important factor in the aetiology and the development of cardiovascular disease [7].

Among the factors that increase the risk of CHD and blood pressure—in addition to age, obesity, sleep disorders and cigarette smoking—are stress at work and shift work [4, 5, 26, 27]. In addition to stress, whose role in the pathogenesis of cardiovascular disease is quite well documented, there is the open matter of physical activity. There is agreement as to the positive influence of recreational effort in the prophylaxis of that disease. Paffenbarger, Hyde, Wing, et al. have reported a positive effect of regular weekly recreational physical effort at the level of over 2000 kcal [11, 30]. Regular effort probably has a positive influence on total body weight, blood pressure, level of cholesterol and tolerance to glucose [11].

To date there has not been a definitive explanation if physical activity related to occupational work can be considered an independent factor that lowers cardiovascular risk. Moreover, there are reports that doing hard physical work over many years increases incidence of heart disorders or episodes of acute CHD. In Ilmarinen's study most cases of diagnosed CHD over 5 years concerned people, both women and men, who did hard physical work [19].

We are aware that the relatively small number of subjects in our study prevents us from generalizing the results. However, it seems that our observations regarding cardiovascular risk factors can be very important in planning preventive activities for various occupational groups. If prophylaxis is to be effective, very early identification of risk factors and assessment of cardiovascular risk itself is important; this in turn will make taking the right steps to eliminate those factors possible.

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