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Job Strain, Overtime, Life Style, and Cardiovascular Risk in Managers and Physical Workers

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The purpose of the study was to determine the relation between overtime, job strain and life style, and cardiovascular risk (CVR) in 97 managers and 98 physical workers. CVR was measured with the Framingham method. Information about job strain, overtime, life style and extra-occupational activities was obtained with a self-administered questionnaire. The results showed that both groups had a similar, medium-level job stress. Being a manager and having extra-occupational activities (self-education) were significantly related with CVR ($p = .000$, $p = .035$, *respectively), whereas other factors that were analysed (i.e., physical work and overtime) were not. The managers were older than the physical workers; that may be why the factor of being a manager was significantly related to CVR. The extra-occupational activities connected with improving workers' skills may play an important role in the development of workers' overload and an increase in CVR.*

cardiovascular risk job strain overtime life style type of work

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1. INTRODUCTION

Cardiovascular risk (CVR) is defined as the probability of developing ischemic heart disease (IHD) in a given person in a specific period. CVR risk should be assessed in healthy people to identify those highly threatened with IHD before the onset of clinical symptoms or manifestation of the disease, and then to implement the principles of primary prevention [1]. In practice, determination of CVR is most often based on an analysis of incidence of cardiovascular disease threat factors. In the Framingham method those factors are gender, age, arterial blood pressure, cigarette smoking and the total cholesterol level [2]. In the method the National Cholesterol Education Program (Adults Treatment Panel III) uses gender, age, arterial blood pressure and cigarette smoking are included in addition to early occurrence of cardiovascular diseases in the family and high level of low density lipoproteins (LDL) [3]. In 1998 the American Heart Association (AHA) proposed the most complex overview of CVR factors; it also considers the weight and height, body mass index (BMI), and nonspecific changes of the ST section in the resting electrocardiogram as indicators of coronary arterial disease [4].

Other CVR factors, referred to as causal, conditional and predisposing, have been identified as a result of numerous clinical examinations. How the factors are classified depends on their role in the pathogenesis of IHD. Causal factors (according to AHA) include cigarette smoking, arterial hypertension, high concentration of total cholesterol and LDL fraction, low concentration of high density lipoprotein (HDL) fraction of cholesterol and diabetes. Conditional factors include higher concentration of triglycerides, LDL, abnormal concentration of lipoproteins, high concentration of homocysteine and high concentrations of coagulation factor. Predisposing factors are obesity, lack of physical activity, premature IHD in the family medical history (i.e., myocardial infarction or sudden heart death of a male first-degree relative under 55, or of a female first-degree relative under 65), socioeconomic factors, ethnic and behavioural factors, male gender and insulin resistance.

Traditionally, certain behavioural factors, mainly lack of physical activity and smoking, are also identified as CVR factors. Many reports on the working environment as another risk factor of cardiovascular diseases can be found in the literature [5, 6]. The authors of this paper became interested in the significance of various factors characterizing the load of workers in their workplace, such as paid work load (type of work, overtime, job strain) and, on the other hand, sports and recreation. This choice of factors is based on the belief that strong engagement in paid work (defined by the time devoted to it) and work-related psychosocial stress determine lack of prohealth behaviour (by decreasing the possibility to pursue active recreation) and thus cause an increase in CVR.

The purpose of the study was to determine the relationship between the type of work, overtime, job strain and extra-occupational activities, and CVR in two groups: managers and physical workers.

2. MATERIALS AND METHODS

The investigation was carried out in two groups of males with two different types of work. One group comprised employees with administrative tasks and managerial posts (i.e., supervising at least 5 subordinates) that required a high degree of availability and responsibility, hereinafter referred to as managers. The other group comprised employees who worked physically; their energy expenditure exceeded 1528–2359 kcal per shift (8 h).

The investigation involved 195 people (97 managers and 98 physical workers). Table 1 lists their age and basic anthropometric data.

The participants did not report any symptoms of IHD or take any cardiologic or hypertensive medication. Participation in the study was voluntary. It took place during preventive periodic medical examinations.

Three kinds of investigation were carried out: (a) questionnaire investigations to assess psychosocial factors of the working environment and

TABLE 1. Participants' Age and Anthropometric Data by Occupation

Parameter		Managers	Physical Workers	Total
Age (years)	*M*	47.7	36.2	41.9
	SD	10.7	10.4	12.0
	range	25–68	24–61	25–65
Body mass (kg)	*M*	85.6	84.2	84.9
	SD	11.7	12.9	12.3
	range	55–115	54–120	54–120
Body height (cm)	*M*	175.0	176.3	175.6
	SD	14.2	7.5	11.3
	range	102–204	160–198	102–204
Body mass index	*M*	28.9	27.1	28.0
	SD	10.0	3.9	7.6
	range	19.9–85.7	20.1–44.5	19.9–85.7

Notes. Managers: $N = 97$; physical workers: $N = 98$; total: $N = 195$.

possibilities to pursue active recreation during time off work; (b) medical examination to determine blood pressure (BP); body mass, height and waist measurements of the participants, and interviews concerning family history of premature IHD; and (c) biochemical factors of risk of IHD (total cholesterol, LDL, HDL, triglycerides, glucose, insulin and fibrinogen).

The psychosocial working conditions (PWC) questionnaire was used to assess stress-generating factors in the working environment. PWC measures three dimensions: demands, control and social support [7]. Psychometric parameters of PWC were found to be satisfactory: reliabilities of demands, control and support scales were Cronbach's $\alpha = .82$, .84 and .94, respectively [7].

Assessment of selected aspects of work load (working in the evening, working at weekends and working over 10 h a day) and the load of extra-occupational activities (housework, self-education) was carried out using the questionnaire of the European Foundation for Improvement of Working and Living Conditions [8].

A physician examined each participant. During the examination BP, body mass and height were measured, the waist measurement was taken and each participant was asked if they had a family history of premature IHD, if they smoked and if they took part in sports (every day or sporadically, i.e., less than once a week). The obesity index was accepted as BMI ≥ 30 and the waist measurement ≥ 102 cm.

Standardized methods were used to measure biochemical parameters: total cholesterol, LDL and HDL fraction cholesterol, glucose, triglycerides, fibrinogen and insulin in blood serum. The following values were taken as CVR factors: total cholesterol > 200 mg/dl, LDL > 130 mg/dl, HDL < 40 mg/dl, glucose > 110 mg/dl, triglicerides > 180 mg/dl, fibrinogen > 400 mg/dl and insulin > 27 μU/ml.

The method of CVR evaluation developed by the authors involved in the Framingham research was applied for this examination [9, 10]. The method is based on 10-year risk, with the risk determined on a scale from under 1 to over 30%.

The results of the investigation were analysed with Statistica 6.0. The multivariate regression model was used for estimating the influence of the following factors on CVR: (a) type of work (manager, physical worker); (b) job strain factors in the working environment (requirements, control, social support); (c) overtime (evening work, work on Saturdays and work over 10 h a day); (d) active participation in recreational sports and (e) extra-occupational activities (housework, self-education). The level of significance was .05.

3. RESULTS

3.1. Incidence of CVR Factors

Table 2 shows that over 60% of the participants in both groups had an increased level of total cholesterol. A significant number of participants had a higher than normal level of LDL, both in the group of managers (55%) and, to a smaller degree, in the group of physical workers (39%). The rate of other risk factors was lower, with differences only in an increased level of glucose

TABLE 2. Cardiovascular Risk Factors by Occupation

Risk Factor		Managers	Physical Workers	Total
Total cholesterol (>200 mg/dl)	*N*	98	97	195
	cases	63	61	124
	%	64	63	63
LDL (>130 mg/dl)	*N*	97	94	191
	cases	53	37	90
	%	55	39	47
HDL (<40 mg/dl)	*N*	98	97	195
	cases	11	5	16
	%	11	5	8
Glucose (>110 mg/dl)	*N*	98	97	195
	cases	14	4	18
	%	14	4	9
Triglycerides (>180 mg/dl)	*N*	98	97	195
	cases	23	23	46
	%	23	24	24
Fibrinogen (>400 mg/dl)	*N*	98	97	195
	cases	8	18	26
	%	8	19	13
Body mass index (≥30)	*N*	97	97	194
	cases	18	20	38
	%	19	20	20
Waist measurement (≥102 cm)	*N*	98	97	195
	cases	19	19	38
	%	19	19	19
Insulin (>27 μU/ml)	*N*	98	97	195
	cases	2	4	6
	%	2	4	3
Cigarette smoking	*N*	92	92	184
	cases	39	49	88
	%	42	53	48

Notes. HDL—high density lipoprotein, LDL—low density lipoprotein.

TABLE 3. Assessment of Job Strain

Factor		Managers	Physical Workers	Total
Requirements	*M*	3.0	3.1	3.0
	SD	0.4	0.5	0.4
	range	1.5–4.2	2.0–4.2	1.5–4.2
Control	*M*	3.3	3.2	3.3
	SD	0.5	0.4	0.5
	range	1.9–4.8	2.3–4.7	1.8–4.7
Support	*M*	3.2	3.2	3.2
	SD	0.7	0.6	0.6
	range	1.1–5.0	1.6–5.0	1.1–5.0

Notes. Managers: $N = 98$; physical workers: $N = 97$; total: $N = 195$.

(more frequent among managers) and fibrinogen (more frequent among physical workers). Almost half of the participants (mostly physical workers) smoked cigarettes.

Prevalence of obesity (BMI ≥ 30) and abdominal obesity (waist measurement ≥ 102 cm) occurred altogether in 20% of the participants, to a similar degree in both occupational groups. Both occupational groups had a similar level of demands, control and social support. However, the managers had a slightly higher mean level of control (Table 3).

3.2. CVR in Managers and Physical Workers

The multivariate regression model was significant; independent variables used in the model explained only 9% of variability of the dependent variable (the value of adjusted R^2). The character of work and extra-occupational activities was significantly related with the dependent variable. Being a manager increased risk by over 3.5 points (standardized β = 0.29, p = .000), and extra-occupational activities by 1.95 points (standardized β = 0.15, p = .035) (Table 4).

4. DISCUSSION

The main IHD risk factors, i.e., gender, age, arterial blood pressure, cigarette smoking, early occurrence of IHD within one's family, a high level of cholesterol, LDL and obesity have been known for years. Numerous international studies proved their role in the pathogenesis of atheromatous changes leading to a clinical manifestation of the disease. However, there have been fewer reports on the influence of factors characterizing the working environment on the development of CVDs. Usually the latter are considered in the context of the character of work and work-related stress [11, 12, 13, 14].

For years, investigators have focused on the relation between CVR and physical work of different intensity. Menotti and Seccareccia analysed 99 029 railway employees aged 40–59 [15]. They were interested in the incidence of sudden death, myocardial infarction, stroke and other cardiovascular diseases, chronic bronchial inflammation and neoplasm in this group of workers. The participants were divided into groups depending on their scope of responsibility and the intensity of physical work. The authors found the highest incidence of myocardial infarction in employees with low intensity of work (sitting work) and high responsibility.

The limitation of our study is that the explanation of the variability of the dependent variable is low (adjusted R^2 = 9%). However, our investigation showed that the type of work (managerial versus physical) and involvement in extra-occupational activities had a statistically significant influence on CVR. It seems logical that extra-occupational activities, due to their excessive time burden, reduce the employees'

TABLE 4. Regression Analysis of Cardiovascular Risk (According to Framingham [9, 10]) and Type of Work, Job Strain, Overtime, Lifestyle (*N* = 199)

Factor	β	*SE*	B	*SE*	*p*
Intercept	—	—	13.67273	4.804870	.004925
Occupation	0.287734	0.717960	3.57029	0.890870	.000088
Requirements	–0.055627	0.071718	–0.75257	0.970258	.438939
Control	–0.076464	0.085780	–1.04250	1.169512	.373855
Support	–0.076003	0.082833	–0.77895	0.848952	.360032
Sports: rarely	–0.073561	0.161518	–0.92005	2.020153	.649321
Sports: every day	–0.015314	0.161321	–0.19008	2.002334	.924473
Evening work	0.022188	0.070961	0.03481	0.111344	.754872
Work on Saturday	–0.075885	0.069183	–0.03194	0.291211	.274105
Work more than 10 h a day	–0.066815	0.071748	–0.09015	0.096807	.352920
Extra-occupational activities	0.147084	0.069475	1.95412	0.923032	.035569

free time and limit possibilities of creating prohealth behaviours (e.g., the opportunity to take part in recreational sports on a regular basis). At the same time, those activities may also be the reason for bad nutrition habits, including irregular meals, thus increasing life risk factors for CVD [16]. Wickram, Lorenz, Conger, et al., when analysing the relationship between work and employees' health, pointed out that highly qualified occupations with high social prestige and financial status create better conditions for participation in social and informal life, which in turn, may reduce work-related stress [17].

The issues connected with work-related stress, in assessment of CVR, have been investigated for many years. Psychosocial stress at work is often considered as a consequence of three basic dimensions: demands, social support and control [18]. There are also other methods of defining occupational stress, e.g., responsibility, measured as an influence on economic decisions and possible financial consequences, or the effort–reward imbalance [15, 19].

Johnson, Stewart, Hall, et al. investigated over 12000 people 25–74 years old employed in Sweden. They studied the influence of psychological and social working conditions on mortality caused by IHD diseases and found a clear relationship between low work control and the risk of cardiovascular death [20]. According to Kivimäki, Leino-Arjas, Luukkonen, et al., a high level of stress (described as a high or medium level of requirements and a low level of control) and non-equivalence between commitment to work and remuneration increased the risk of IHD death and influenced an increase in BMI and in the level of total cholesterol [21]. Our earlier investigations showed that being a manager and an imbalance in the work–home relationship were independent factors of IHD risk [22]. According to Kivimäki, Ferrie, Brunner, et al., justice at work remained an independent predictor of the incidence of coronary heart disease [23].

The opinion that high stress at work is an important factor of IHD risk has not been confirmed by other results based on an analyses of case histories of 3039 people aged 18–77, examined over the 10 years of the Framingham project [24]. In our study, too, the three investigated predictors of strain (requirements, control and social support) did not have a significant influence on the CVR.

It is puzzling that in the current study there was no significant relationship between indices determining overtime work load (working in the evening, on Saturdays and more than 10 h a day), which also decrease the employee's free time, with incidence of CVR. This can be explained by the fact that relatively few participants worked in such conditions. It is worth noting that results of other investigations show that workload exceeding 11 h per day increases the IHD risk [25]. Ha and Park's study showed an association between the duration of shift work and the metabolic risk factors of cardiovascular disease [26].

However, the results indicating a significant relationship between managerial activities and CVR that we obtained should be treated with certain caution. In the group of managers, more people were over 45 years of age than in the group of physical workers, which might have a significant influence on the result.

In summary, our results indicate that CVR should be assessed in healthy employees, even though in our study most participants had low-to-moderate CVR. The observation that being a manager increased CVR more than twofold has a very practical significance: managers require occupational health professionals' special supervision and preventive activities.

In our opinion, another observation from this study, i.e., the role of after-work activities in the development of CVR, has even greater practical significance. This factor should not be underestimated. We believe that it is time to discuss the problem of work culture. A propper approach to the work–after work time balance (and its management) is a very important topic in the policy of creating a healthy working environment.

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