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General Medical Examination of the Employed for Screening for Increased Cardiovascular Risk

Dragan Janković[1,*], Manda Herceg[2], Dunja Stolnik[3], Nikola Volarić[2], Sanja Bekić[2], Ljiljana Majnarić Trtica[4]

[1]Institute of Emergency Medicine of Vukovar-Srijem County, Croatia
[2]School of Medicine, University Josip Juraj Strossmayer, Croatia
[3]Health Centre Osijek, Park King Petar Kresimir IV. 6, Croatia
[4]School of Medicine, Department of Family Medicine, Department of Internal Medicine, University Josip Juraj Strossmayer, Croatia

Abstract Introduction: Systematical calculation of cardiovascular risks with middle aged persons is not recommended, but in that age start of measures of primary prevention is recommended. Methods: Retrospective research study. Laboratorial data were used from persons aged 40 to 50 who have done a physical examination for working employees in the private Medical Centre for Occupational Medicine during 2014. Results: There were 54% of overweight examinees, 17% really obese, with a greater representation of men. Higher systolic blood pressure was found with 24% of males and 10% of females, a diastolic with 28% of males and 8% of females. High total and LDL cholesterol were found with 71% of examinees, while low HDL cholesterol and high triglycerides were found with 21% i.e. 25% of examinees, regardless of gender. Conclusion: Register of physical examinations of employees should be used as a source of information on representation of cardiovascular risks with middle aged persons, which would allow a timely start of measures of primary prevention.

Keywords Middle Age, Prevention, Risk Factors

1. Introduction

Modern society is faced with a steady rise in chronic non-communicable diseases and their negative effects on the working and living capacity of the population, as well as with the pressure these diseases pose on the health system and society as a whole. [1] The predominant chronic disease in Europe, both in morbidity and mortality, is cardiovascular disease (CVD), making up 45% of all deaths. Each year, more than 4 million people in Europe die of cardiovascular disease, 1.4 million of whom are under 75 years old. [2] Therefore, numerous studies focus on the importance of the prevention and the negative consequences of this disease. This has led to the conclusion that public health measures, education and raising awareness of risk factors can prevent major groups of chronic diseases, because they share some of the pathogenic mechanisms, namely CVD, diabetes, malignant diseases, neurodegenerative diseases and dementia [3].

Large prospective epidemiological studies, such as Framingham study, have identified the major risk factors whose presence increases the risk of accelerated arteriosclerotic diseases. These factors, known as the classic CV risk factors, include: age, hypertension, smoking, obesity, diabetes, impaired glucose tolerance, increased serum concentration of lipids, impaired serum levels of lipids (dyslipidaemia), and sedentary lifestyle. Given that many of the afore-mentioned risk factors are the result of an inadequate lifestyle, by implementing primary prevention measures, efforts are made to prevent the onset of cardiovascular disease.

The aim of the paper is to show that from the employees´ general physical exam register we can derive data about CV risk factors in the work active middle age population. Thus obtained data can serve in the implementation of primary prevention of CV disease.

2. Materials and Methods

The study was conducted in the private Medical Centre for Occupational Medicine. Laboratory findings taken in order to carry out general medical (periodic) examination of employed middle-aged people, aged 40 – 50, during 2014, were analysed. The variables taken from patients' medical records were: age, gender, body weight and height data, and blood pressure values.

We analysed data related to cardiovascular health status (fasting blood glucose, total and LDL-cholesterol, HDL-cholesterol and triglycerides), findings suggestive of non-alcoholic fatty liver disease (NAFLD), and chronic alcoholism (gamma-GT).

Data on the number of employees examined, along with individual laboratory findings and findings from their medical records, which are indicating the increased risk factors, are expressed as ratios (absolute numbers) and percentages (%). Categorical data are presented with absolute and relative frequencies. The difference in the distribution of categorical variables between the observed groups was tested by Fisher's exact test and the $\chi 2$ test. All P-values are two-sided. The significance level is set at p=0.05. The statistical program SPSS (version 20.0, SPSS Inc., Chicago, IL, USA) was used for statistical analysis.

3. Results

This study included 100 respondents, 50 of whom were female and 50 male, between 40 and 50 years of age. There is a significant difference in body weight between genders (Fisher's exact test, p=0.007), as shown in Figure 1.

Figures 2 and 3 present that subjects differ significantly in systolic and diastolic blood pressure values between genders as well (Fisher's exact test, p<0.001) (Figure 2).

Significant correlation was found between systolic blood pressure and body mass index (Fisher's exact test, p=0.001), as presented in Table 1.

Table 2 presents a significant correlation found between blood glucose values and the body mass index (Fisher's exact test, p=0.039).

Table 3 shows the correlation between elevated triglyceride values and decreased HDL- cholesterol values (Fisher's exact test, p=0.035).

Detailed analysis of the results and their correlation with the relevant literature is presented in the discussion.

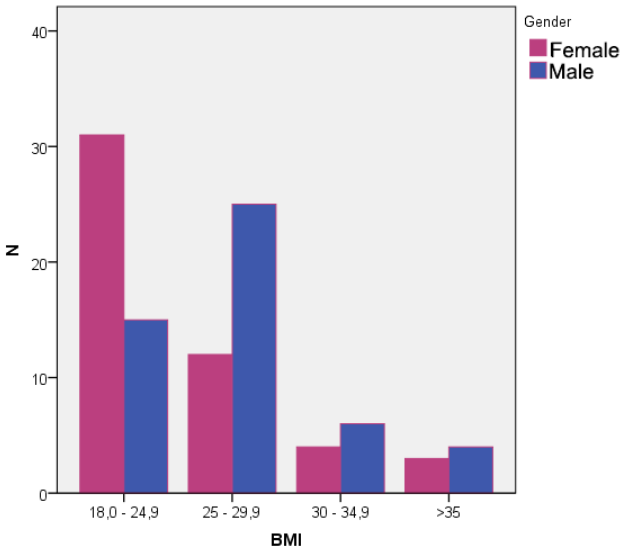

Figure 1. Gender-related differences in body weight

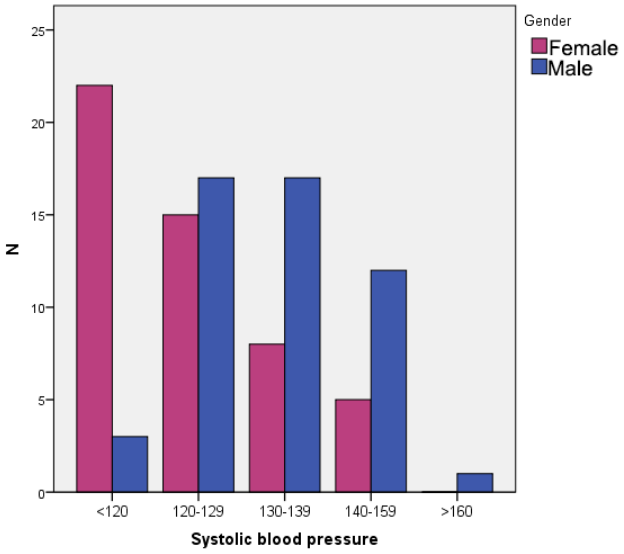

Figure 2. Gender-related distribution of systolic blood pressure

Table 1. Correlation between systolic blood pressure index and body mass index

		BMI N (%)				Total	P*
		18.0 – 24.9	25 – 29.9	30 – 34.9	> 35		
Systolic blood pressure (mmHg)	< 120	20 (43.5)	4 (10.8)	0 (0.0)	1 (14.3)	25	**0.001**
	120 – 129	12 (36.1)	18 (48.7)	1 (10.0)	1 (14.3)	32	
	130 – 139	7 (15.2)	9 (24.3)	7 (70.0)	2 (28.6)	25	
	140 – 159	6 (13.0)	6 (16.2)	2 (20.0)	3 (42.8)	17	
	≥160	1 (2.2)	0 (0.0)	0 (0.0)	0 (0.0)	1	
Total		46 (100.0)	37 (100.0)	10 (100.0)	7 (100.0)	100	

*Fisher's exact test

Table 2. Correlation between blood glucose values and body mass index

		BMI N (%)				Total	P*
		18.0 – 24.9	25 – 29.9	30 – 34.9	> 35		
Glucose (mmol/L)	Low values (< 4.4)	3 (6.5)	0 (0.0)	1 (10.0)	0 (0.0)	4	**0.039**
	Normal values (4.4 -6.4)	43 (93.5)	35 (94.6)	7 (70.0)	7 (100.0)	92	
	High values (> 6.4)	0 (0.0)	2 (5.4)	2 (20.0)	0 (0.0)	4	
Total		46	37	10	7	100	

*Fisher's exact test

4. Discussion

Slightly less than 50% of respondents, namely 46%, had normal body weight, almost twice as more women than men (Figure 1). Although the sample is small, the results generally correspond to the national epidemiological data, according to which about 38% of the adult population of the Republic of Croatia is overweight, and 20% are obese, with slightly more men than women [4]. Similar data have also been found for Europe and they indicate a steady growth of the obesity, both in developed and developing countries, and in all age groups as well, including adolescents and children [5]. This is often attributed to a modern lifestyle, which is predominantly sedentary, and to variety of available food with high levels of fat and simple carbohydrates. It is well known that excess body weight is often associated with other factors of increased risk of CV diseases, such as hypertension, impaired glucose tolerance, hypercholesterolaemia and hypertriglyceridaemia [6]. People with excessive body weight have an increased risk of developing not only CV disease, but also some of the other chronic illnesses. Reduced work productivity and overall activity level are also linked to it, with the increased cost for the society [7].

However, hypertension cannot be fully attributed to the excessive body weight, because there are also people with hypertension who do not have the increased body mass index [8]. Continuous long-term psychological stress could also affect the occurrence of hypertension, particularly in terms of inadequate workplace conditions and lower socioeconomic status [9]. All these factors constitute hypertension as a multifactorial disorder with intertwined influence of environmental and genetic factors, as confirmed by the latest human genome analysis [10]. Variable influence of environmental and genetic factors on the occurrence of hypertension is also one of the reasons why the results of most major epidemiological studies, but not all, have shown that the incidence of elevated systolic and diastolic blood pressure is higher in men than in women in their middle age, which is consistent with the results obtained in our research. Gender related differences disappear gradually in older age, while at the age of 70 and more, women outnumber men in the frequency of hypertension [11].

The awareness of hypertension and blood pressure control are important for people between 40 and 50 years of age, because that is the age when the frequency of hypertension in the population increases. On the other hand, our results show that middle-aged women are often prone to hypotension (systolic pressure <120 and diastolic <70 mmHg). As many as 22 women (44%) have systolic blood pressure <120 mmHg, while there are only 3 (6.0%) men with the similar systolic blood pressure levels. Regarding the value of diastolic pressure <70 mmHg, there are not any men, while we found 8 women in that group (16%). Elevated diastolic pressure ≥ 90 mmHg was found in 4 women (8.0%) and as many as 14 men (28.0%) (Table 1, Figures 2 and 3).

Table 3. Correlation between triglycerides and HDL-cholesterol

		HDL-cholesterol (mmol/L)		Total	P*
		Low values	Normal values		
		N (%)	N (%)		
Triglycerides (mmol/L)	Normal values (< 1.7)	12 (57.1)	63 (79.7)	75	**0.035**
	High values (1.8 – 2.9)	4 (19.0)	12 (15.2)	16	
	High values (3.0 – 4.9)	3 (14.3)	3 (3.8)	6	
	High values (> 5.0)	2 (19.5)	1 (1.3)	3	
Total		21	79	100	

*Fisher's exact test

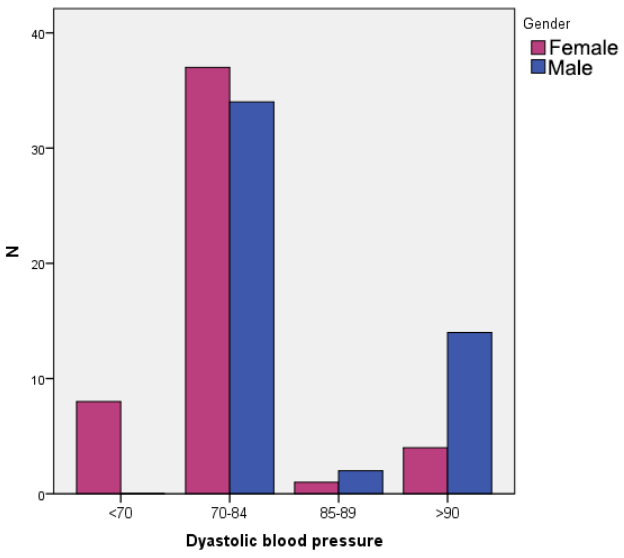

Figure 3. Gender-related distribution of dyastolic blood pressure

Statistically significant difference in blood glucose values was not found in our study, but significant correlation between blood glucose values and the body mass index was found (Fisher's exact test, p=0.039) (Table 2). Respondents with normal BMI did not have elevated blood glucose counts, while 5.4% of people with excessive body weight and 20% of obese people had elevated values of blood glucose. It is also interesting to note that in one obese respondent lowered blood glucose count was found (<4.4 mmol/L), which could be explained by hyperinsulinaemia, or the impaired glucose tolerance. Results suggesting a correlation between the excessive body weight and increased blood glucose concentration, corroborated in this study by a small number of subjects (4 out of 54), could be explained by the well-known effect of insulin resistance on the rise in serum glucose concentration in non-diabetic people. Specifically, the development of insulin resistance, in addition to excessive body weight, is adversely affected by the age, hypertension, increased degree of systemic inflammation, and some other factors; in other words there is not any simple linear relationship between the increased body mass and insulin resistance level, which is reflected in increased fasting blood glucose concentration. In addition, it is known that abdominal obesity (measured by waist circumference) correlates highly with glucose metabolism impairments in comparison to obesity expressed as BMI. If we measured, during general medical examinations of the employed, postprandial blood glucose levels (2 hours post-meal), which can indicate impaired blood glucose tolerance (while, on the other hand fasting blood glucose levels indicate hyperglycaemia), the number of people with impaired glucose metabolism in the pre-diabetes stage would probably be higher [12]. Slightly less than 1/3 of all subjects (29%) had normal cholesterol values, while 12% of subjects had very high values (7.0 mmol/L and above). Very similar ratios were also found for LDL-cholesterol. Both lipid parameters are of atherogenic lipid profile, and until recently, only total cholesterol was measured as part of a standard lipid profile key to estimating CV risks [13]. The results of our study are comparable to data from the world-wide research.

National Screening Program, conducted in the United States 2009 – 2010, found that the incidence of hypercholesterolaemia in the adult population was 13.5%, with the threshold value of cholesterol being 6.2 mmol/L (240 mg/dl) [14]. Increased cholesterol is an important risk factor for coronary artery disease, however, medication therapy is not recommended if the total CV risk is not high. However, in middle-aged people (40 – 50 years old), it is necessary to calculate relative CV risk if there is a significant presence of some risk factors such as smoking, high cholesterol level and/or hypertension, which may encourage the initiation of medication therapy for treating hypertension, or initiate education for the change of unhealthy lifestyles [13]. Smoking status data should be systematically recorded as part of general medical examination of the employed. We believe that it is important to report the possible early emergence of CV incidents in the closest family members (parents, brothers/sisters) because middle-aged people with the presence of CV factors in family medical history need intensive education and more frequent control of CV risk factors [13].

In our study, we paid special attention to the values of triglycerides and HDL-cholesterol due to dyslipidaemia within the metabolic syndrome. Reduced values of HDL-cholesterol were found in 21 subjects (21%), without significant gender differences. Increased triglyceride values were found in 25% of subjects, also without gender differences, with slightly elevated to high triglyceride levels (≥3.0 mmol/L) found in 9% of respondents. Such incidence of these disorders does not deviate from the observed frequency of obesity and hypertension, which could also be considered as elements of the syndrome. There is a mutual correlation between these two lipid disorders, which indicates that, apart from low HDL-cholesterol, we may also expect elevated triglyceride levels, or vice versa (Table 3). In fact, during the remodelling of lipoprotein rich with triglycerides, small highly atherogenic cholesterol-rich particles are formed, while HDL-cholesterol loses its anti-inflammatory and anti-atherogenic activity by participating in these metabolic processes. The results of previous studies show that this association between HDL-cholesterol and triglyceride is not linear because the current serum concentrations of HDL-cholesterol and triglyceride, other than BMI, will be influenced by other factors as well, such as age, kidney function, alcohol intake or some comorbidity [15, 16]. Serum concentrations of HDL-cholesterol and triglyceride are more likely to be mutually linear and reciprocal if there are less of these additional factors.

Other laboratory findings comprised of: laboratory findings of liver function, liver transaminases AST and ALT, and GGT enzyme. Increased values of these findings may be indicators of fat transformation of the liver, which is also one of the signs of metabolic syndrome [17]. Other factors, such as taking specific medications, chronic hepatitis or drinking, may also affect the level of the aforementioned findings, or liver damage. Only male respondents were subjected to AST tests, and the elevated values were found in 2 respondents. All of the employed were subjected to ALT tests, due to its well-known sensitivity, especially in comparison to AST tests, to liver damage screening. Only 4 male participants had elevated ALT values. Seven participants, 4 female and 3 male, tested positively for elevated values of GGT enzyme, a marker of chronic liver injury, which serves as a sensitive indicator of chronic alcoholism. The impaired liver function test by laboratory findings could be a first step in targeting individuals for alcohol consumption.

5. Conclusions

Although, according to current evidence, screening of

middle-aged people for CV risk factors is not recommended, general medical examination database, including laboratory findings that are standardly done during the examinations of the employed, could serve as a valuable source of information on overall health, and in particular, on the presence CV risk factors in middle-aged people, which would allow timely initiation of primary prevention measures for CV disease. This would be of particular importance for the active working population, whose improved health condition has been shown to have a beneficial effect not only on reducing treatment costs but also on overall costs of society.

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