



## CHARACTERISTICS OF ARTERIAL HYPERTENSION IN INDUSTRIAL WORKERS

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**Summary.** *The aim of this study is to analyze the prevalence and characteristics of arterial hypertension in industrial workers from the region of Niš. The research included a sample of 1725 workers employed in eight small plants. Analysis of work and work place conditions was done on work places of examined workers. In accordance with demands of work places (work in shifts, nightly work, work in norm) and presence of professional noxiousness the population under study was divided into 14 groups. Work, personal, familiar, social and anamnesis of disease was done of all workers. Detailed clinical examination, antropometric measurements, examination of blood concentration of glucose, cholesterol, triglycerides, urea and electrolytes in serum, electrocardiography, inspection of eye bottom, neurologic examination, stress test on ergo bicycle, Doppler echosonography of blood vessels of low legs were done. The prevalence of arterial hypertension is higher in the groups of workers professionally exposed to noise, to lead vapors, in shift and nightly workers than at the workers in workplaces without contact to professional noxiousness. Hypercholesterolaemia and hypertriglyceridaemia are presented statistical more in the workers exposed to professional noxiousness, where is also, the more prevalence of arterial hypertension. The small numbers of hypertensive workers behave to harmonize the prescribed therapy and advice. Arterial hypertension in working population presents a significant medical problem. Professional noxiousness (noise, lead vapors) special demands of work (shift work, night work, work in norm) and various combinations of them with simultaneous effects can be a contributing factors in developing of arterial hypertension, hypercholesterolaemia and hypertriglyceridaemia at exposed workers.*

**Key words:** *Industrial workers, arterial hypertension, professional noxiousness, coronary risk factors, occupational exposure*

### Introduction

Arterial hypertension is very important problem for society and health service because of it's epidemiological characteristics (great dissemination, more frequent appearance in some population groups, important influence on morbidity and mortality), socioeconomic consequences (expensive therapeutic treatment, decreased working ability, absence, early dying) and numerous complications of health state. In accordance with great prevalence in adult population and significant health damage of sick people, arterial hypertension presents one of the essential public health problems in Europe (1) and also out of it (2). Epidemiological researches found arterial hypertension at 16% of adults in Switzerland (3), at 29% inhabitants in Venezuela (4), 34% of population in Egypt (5) and about 40% of population on African continent (6).

Diastolic arterial blood pressure between 90 and 99 mmHg have about 57% of people in western countries, and between 100 and 120 mmHg about 28-42% of ex-

posed people (7). Arterial hypertension with 15-25% prevalence (13,22) in industrial workers presents important socio-medical and economic problem.

Industrial noise can be a contributing factor in developing of arterial hypertension and other coronary risk factors in exposed workers (1,8).

The risk of coronary artery disease is higher in hypertensive workers older than 45 years (9). Only one half of hypertensive patients get antihypertensive treatment, and among them only one half get proper antihypertensive treatment (2, 7).

The aims of this research are determination of hypertension incidence in industrial workers, relationship between hypertension and work requirements as well as occupational harmful factors, assessment of clinical types of hypertension and ischaemic heart disease risk factors in workers with hypertension, including the role of work-related factors and analysis of information on hypertension treatment.

## Patients and Methods

The research included a sample of 1725 workers employed in eight small plants that are localized in the region of Niš. Analysis of work and work place conditions was done on work places of examined workers. In accordance with demands of work places (work in shifts, nightly work, work in norm) and presence of professional noxiousness (noise exceeding 85 dBA, lead vapors in concentrations higher than  $0.15 \text{ mg/m}^3$ ), the population under study was divided into 14 groups. The group 1 consisted of 123 workers without presence of professional noxiousness and special demands of workplaces. The group 2 included 124 workers professionally exposed to noise. The group 3 included 119 night workers. The group 4 consisted of 124 night workers exposed to noise. The group 5 included 122 shift workers. The group 6 consisted of 118 shifts and nights workers exposed to noise. The group 7 included 124 shifts workers exposed to noise. The group 8 consisted of 119 workers exposed to lead vapors. The group 9 included 125 workers exposed in the same time to lead vapors and noise. The group 10 consisted of 119 night workers exposed to lead vapors. The group 11 included 129 night workers exposed to lead vapors and noise. The group 12 consisted of 123 shift workers exposed to lead vapors and noise. The group 13 included 124 shifts and night workers exposed to lead vapors. The group 14 consisted of 132 shifts workers exposed to work in norm, lead vapors and noise. (Table 1). All studied groups were of similar structure with regard to factors other than professional exposure to various noxiousness than can affect cardiovascular system. Statistical analysis of structure of these groups fortified that there hadn't been statistically important difference between mentioned groups related with sex, age, length of work, smoking cigarettes and alcohol intake habits and family predisposition to arterial hypertension ( $p > 0.05$ ).

Work, personal, familiar, social and anamnesis of disease was thoroughly done of all workers. Detailed clinical examination, antropometric measurements, laboratory examinations (examination of blood concentration of glucose, cholesterol, triglycerids, urea and electrolytes in serum) and additional examinations (electrocardiography, inspection of eye bottom, neurologic examination, when it is indicated stress test on ergo bicycle, coronarography, Doppler echosonography of blood vessels of low extremities) were done.

Measuring blood pressure was done by sphygmomanometer in sitting position of patient, with arm beneath on the table and lifted to heart height, without previous physical activity, without consuming coffee and without using cigarettes at least 30 minutes before measuring and after 5 minutes talking with the patient. At every examination 3 measures were done with 2 minutes of pausing. The moment of appearance sound of Korotkov was taken for systolic pressure, and the moment of their disappearance for diastolic pressure. The average value was calculated from 3 measures. The

four measurements of blood pressure at intervals of 3-5 days between each measuring were done (9). Arterial hypertension was considered when systolic blood pressure value was higher than 140 mmHg or diastolic pressure higher than 90 mmHg (9). According to clinical types, arterial hypertension was clustered into one of these 3 groups:

Unstable hypertension - when patient has arterial hypertension repeatedly, with permanent hesitation, but normalize without therapy.

Fixed hypertension without involving vital organs - when chronic hypertension exists, with continual high values of blood pressure and it doesn't normalize without therapy. Complications still doesn't exist on vital organs.

Fixed hypertension with complications on vital organs - when chronic hypertension exists with continual high values of blood pressure and with complications on vital organs (hypertrophy of myocardial left ventricle, damaging of kidney, disturbances of nervous system, changes on eye bottom, organic damages on blood vessels, coronary heart disease).

Blood samples were drawn after an overnight fast, between 7.00-8.00 a.m., by cubital veinpuncture. Serum cholesterol was determined by a colorimetric method (normal values between 3.88 and 6.5 mmol/l). Serum triglycerides concentration was determined by extraction method (normal values between 0.48 and 1.88 mmol/l).

Body mass index (Quetelets index) was used to show the ratio of body weight (W) and height (H) by following formula:

$$Q_i = W / H^2$$

-Values of  $Q_i$  less than 2.13 were considered the sign of underweight,

-Values of  $Q_i$  between 2.14 and 2.56 were considered the sign of normal weight,

-Values of  $Q_i$  above 2.57 were sign of overweight.

Therapy of arterial hypertension was analyzed in workers with arterial hypertension. Hygienic and dietary vital regime were suggested to all patients with arterial hypertension (general measures and diet). General measures were presented like regular rhythm of life (yearly, weekly, daily rhythm of work and rest) and moderate recreate physical activity, presented with 3-5 times weekly recreation in duration of 30-45 minutes. Diet was presented with weight reduction, decreased consuming of salt, lessening of caloric food, break of smoking cigarettes, soberly consuming alcohol and avoidance of animal fats in nutrition. Medicament treatment was suggested to patients without normalize of blood pressure after hygienic and dietary regime and also in case of complications

Statistical significance of data analyzed and compared with results concerning persons who worked without exposure to factors in question or special work requirements (123 workers) were evaluated using Chi quadrate and Student's t tests.

## Results

The examined groups were similar with regard to factors other than professional noxiousness exposure that can affect cardiovascular system. The all groups have similar structure according to sex, obesity, hereditary predisposition to arterial hypertension, number of workers occupied with sport and recreation, number of workers with smoking cigarettes and alcohol intake habits ( $p > 0.05$ ) (Table 1 and Table 2).

Blood pressure analysis of 1725 industrial workers showed that 366 (21.2%) workers had arterial hypertension. It was not found significant difference in the prevalence of arterial hypertension between men and women. The prevalence of arterial hypertension raised with the age of workers (Table 3). The prevalence of arterial hypertension raised with the duration of occupational exposure (Table 4). With the oldness of examined persons raised the number of workers with higher values of diastolic blood pressure. The great percent of workers (11.5%) have diastolic blood pressure between 85-89 mmHg (Table 5).

The greatest number of examined workers have fixed arterial hypertension without complications (47.8%) (Table 6).

With the duration of occupational exposure raised

the number of workers with fixed hypertension with complications (Table 7).

Noise exceeding 85 dBA, work at norm, night and shifts and lead vapors in concentrations higher than  $0,15 \text{ mg/m}^3$  and various combinations of these factors with simultaneous effect are listed as working environment factors whose effect on hypertension and coronary heart risk factors was analyzed. Based on these factors the population under study was divided into 14 groups in which the incidence of hypertension, hypercholesterolemia and hypertriglyceridemia was assessed.

The least prevalence of arterial hypertension was established at workers that work on work places without special demands and without presence of professional noxiousness (8.1%). On the other side, workers that work in special conditions like noise exceeding 85 dB (A), in air pollution with lead vapors exceeding  $0.15 \text{ mg/m}^3$ , have statistically important higher prevalence of arterial hypertension. Workers on work places where exist combination of noise and lead vapors, and where people work in shifts, in norm and nightly, also have significantly higher prevalence of arterial hypertension (Table 8). Statistical importance exists in comparison with group of workers that work without presence of professional noxiousness and special demands on their work places (group 1).

Table 1. The mean age and occupational exposure duration of workers from studied groups

Studied groups	Number of workers	Mean age (years)		Mean duration of occupational exposure (years)	
		X	SD	X	SD
Group 1 (workers without presence of professional noxiousness and special demands of work places)	123	47.3	11.4	21.4	9.5
Group 2 (workers exposed to noise exceeding 85 dBA)	124	46.8	12.8	20.9	9.7
Group 3 (night workers)	119	46.5	13.1	21.5	9.8
Group 4 (workers exposed to noise exceeding 85 dBA and to nights work)	124	48.1	9.8	22.1	10.9
Group 5 ( shifts worker)	122	47.9	10.5	20.7	9.9
Group 6 (workers exposed to work in shifts, to noise exceeding 85 dB(A) and to work at night)	118	46.9	13.1	22.4	10.1
Group 7 (workers exposed to noise exceeding 85 dBA and to work in shifts)	124	47.1	10.5	20.9	10.2
Group 8 (workers exposed to lead vapors exceeding $0.15 \text{ mg/m}^3$ )	119	48.2	11.1	22.5	9.4
Group 9 (workers exposed to lead vapors exceeding $0.15 \text{ mg/m}^3$ and to noise exceeding 85 dBA)	125	46.9	13.9	21.9	9.7
Group 10 (workers exposed to lead vapors exceeding $0.15 \text{ mg/m}^3$ and to work at night)	119	48.1	12.3	20.8	9.2
Group 11 (workers exposed to lead vapors exceeding $0.15 \text{ mg/m}^3$ , to work at night and to noise exceeding 85 dBA)	129	46.6	14.1	21.9	9.4
Group 12 (workers exposed to lead vapors exceeding $0.15 \text{ mg/m}^3$ , to work in shifts and to noise exceeding 85 dBA)	123	47.2	11.8	22.1	9.3
Group 13 (workers exposed to lead vapors exceeding $0.15 \text{ mg/m}^3$ , to work in shifts and to work at night)	124	49.1	12.8	20.2	9.2
Group 14 (workers exposed to lead vapors exceeding $0.15 \text{ mg/m}^3$ , to work in shifts, to work in norm and to noise exceeding 85 dBA)	132	47.6	12.1	21.8	10.8
Total	1725	47.4	12.7	21.5	10.7

Statistical comparisons of variables between the group 1 and the other groups showed nonsignificant differences.

Table 2. Comparisons of variables between studied groups

Groups	Number of workers	Males	Smokers	Drinkers	Workers occupied in sport and recreation	Over weight workers	Normal weight workers	Workers with positive family history of hypertension
		%	%	%	%	%	%	%
Group 1	123	50.4	60.2	2.4	4.1	21.1	45.5	44.7
Group 2	124	49.2	57.2	1.6	4.8	22.6	39.5	41.9
Group 3	119	51.3	63.1	2.5	4.2	20.2	46.2	36.9
Group 4	124	51.6	62.9	2.4	3.2	17.7	37.9	42.7
Group 5	122	51.6	58.2	2.4	4.1	25.4	45.9	45.1
Group 6	118	49.2	56.8	1.7	2.5	17.8	42.4	44.9
Group 7	124	47.6	60.5	2.4	4.0	19.3	43.5	37.1
Group 8	119	52.1	57.1	1.7	4.2	21.0	43.7	37.8
Group 9	125	51.2	59.2	2.4	4.8	24.8	43.2	42.4
Group 10	119	52.1	63.9	1.7	2.5	23.5	37.8	41.1
Group 11	129	48.8	54.3	2.3	3.9	16.3	37.9	37.2
Group 12	123	51.2	61.8	1.6	3.2	23.6	43.9	38.2
Group 13	124	50.0	62.1	2.4	4.0	22.6	41.1	38.7
Group 14	132	47.7	54.5	0.8	5.3	20.5	39.4	44.7
Total	1725	50.3	59.4	2.0	3.9	21.1	41.9	40.9

Statistical comparisons of variables between the group 1 and the other groups showed nonsignificant differences.

Table 3. Prevalence of arterial hypertension in comparison with age and sex

Age (years)	Men			Women			Total		
	N	Number	%	N	Number	%	N	Number	%
20-30	167	9	5.4	175	10	5.7	342	19	5.6
31-40	178	19	10.7	162	17	10.5	340	36	10.6 *
41-50	180	43	23.9 **	173	42	24.3 **	353	85	24.1 ***
51-60	167	50	29.9 **	177	59	33.3 **	344	109	31.7 ***
61-65	175	60	34.3 ***	171	57	33.3 ***	346	117	33.8 ***
Total	867	181	20.9	858	185	21.6	1725	366	21.2

Statistical comparisons between the age group 20-30 years and the other age groups: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001

Table 4. Prevalence of arterial hypertension in comparison with sex and duration of occupational exposure

Exposure (years)	Men			Women			Total		
	N	Number	%	N	Number	%	N	Number	%
under 10	135	21	15.5	260	41	15.8	395	62	15.7
11-20	243	41	16.9	198	34	17.2	441	75	17.0
21-30	254	58	32.1	197	50	25.4 *	451	108	23.9 *
31-45	235	61	33.7 *	203	60	29.6**	438	121	23.6**
Total	867	181	20.9	858	185	21.6	1725	366	21.2

Statistical comparisons between the exposure group under 10 years and the other exposure groups: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001

Table 5. Distribution of diastolic blood pressure values in comparison with age

Diastolic blood pressure (mmHg)		Age					
		20-30 n=342	31-40 n=340	41-50 n=353	51-60 n=344	61-65 n=346	Total n=1725
Under 60	Number	65	48	45	42	18	218
	%	19.0	14.1	12.7 *	12.2 *	5.2 **	12.6
61-84	Number	236	222	161	114	209	942
	%	69.0	65.3	45.6 **	33.1 ***	60.4 **	54.6
85-89	Number	19	33	62	80	5	199
	%	5.6	9.7*	17.6 **	23.3 ***	1.4 **	11.5
90-99	Number	18	29	79	88	24	238
	%	5.3	8.5	22.4 **	25.6 ***	6.9	13.8
100-109	Number	3	5	2	7	56	73
	%	0.9	1.5	0.6	2.0	16.2 **	4.2
110-119	Number	1	3	2	5	25	36
	%	0.3	0.9	0.6	1.5	7.2 **	2.1
Over 120	Number	0	0	2	8	9	19
	%	0.0	0.0	0.6	2.3 *	2.6 **	1.1

Statistical comparisons between the age group 20-30 years and the other age groups: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001

Table 6. Clinical types of arterial hypertension

	Number	%
Unstable arterial hypertension	93	25.4
Fixed hypertension without complications	175	47.8 ***
Fixed hypertension with complications	98	26.8
Total	366	100.0

The prevalence of fixed hypertension without complications was the more than the other types of arterial hypertension \*\*\* p<0.001.

The prevalence of arterial hypertension in all groups except in the group 1 raised with the duration of occupational exposure (Table 9).

It was registered that coronary risk factors like hypercholesterolaemia and hypertriglyceridaemia significantly more often exist in the group of workers with arterial hypertension in comparison with the group of workers without arterial hypertension (Table 10).

Table 7. Prevalence of some clinical types of arterial hypertension according to duration of occupational exposure

Occupational exposure (years)	Unstable arterial hypertension		Fixed arterial hypertension without complication		Fixed arterial hypertension with complications	
	Number	%	Number	%	Number	%
Under 10	21	19.5	41	23.4	0	0.0
11-20	23	24.7	51	29.1	1	1.0
21-30	25	26.9	41	23.1	42	42.9 **
31-45	24	25.8	42	24.0	55	56.1 ***
Total	93	100.0	175	100.0	98	100.0

Statistical comparisons between the exposure group under 10 years and the other exposure groups: \* p<0.05, \*\*p<0.01, \*\*\*p<0.001

Table 8. Prevalence of arterial hypertension in comparison between the studied groups

Studied groups	Number of examined workers	Number of workers with arterial hypertension	Percentage of hypertensive workers
Group 1	123	10	8.1
Group 2	124	30	24.2 *
Group 3	119	17	14.3
Group 4	124	29	23.4 *
Group 5	122	20	16.4
Group 6	118	31	26.3 *
Group 7	124	27	21.8 *
Group 8	119	22	18.5 *
Group 9	125	27	21.6 *
Group 10	119	23	19.3 *
Group 11	129	36	27.9 **
Group 12	123	32	26.0 **
Group 13	124	24	19.3 *
Group 14	132	38	28.8 **
Total	1725	366	21.2

Statistical comparisons between the group 1 and the other groups: \* p< 0.05, \*\*p<0.01

Presence of hypercholesterolaemia is the least at workers who work at workplaces without special demands and professional noxiousness. Workers that work at night, with noise exceeding 85 dB(A), in conditions of combined exposition to noise, nightly work and work in shifts, as well as combined presence of lead vapors, nightly work, work in shifts or noise, significantly were often suffer from hypercholesterolaemia than group of workers without specific conditions on their job. Workers with arterial hypertension have higher prevalence of hypercholesterolaemia than workers without arterial hypertension (Table 11). Statistical significance exists in comparison with group of workers that work without presence of professional noxiousness and special demands on their work places (group 1).

Hypertriglyceridaemia is most rarely in the group of workers that work without professional noxiousness and special demands on work places. Workers that are exposed to noise, or combined influence of noise, work in shifts or nightly, as well as combined presence of lead vapors, noise, nightly work or work in shifts, have statistically significant higher prevalence of arterial hyperten-

Table 9. Prevalence of arterial hypertension according to the duration of occupational exposure

Studied groups	Duration of occupational exposure (years)								Total	
	Under 10		11-20		21-30		31-45			
	N	%	N	%	N	%	N	%	N	%
Group 1	3	30.0	4	40.0	1	10.0	2	20.0	10	100.0
Group 2	6	20.0	7	23.3	8	16.7	9	30.0	30 **	100.0
Group 3	2	11.8	3	17.6	6	35.3	6	35.3	17	100.0
Group 4	5	17.2	7	24.1	8	27.6	9	31.1	29 **	100.0
Group 5	3	15.0	4	20.0	6	30.0	7	35.0	20	100.0
Group 6	7	22.6	7	22.6	7	22.6	10	32.2	31 **	100.0
Group 7	6	22.2	6	22.2	7	25.9	8	29.6	27 *	100.0
Group 8	1	4.5	2	9.1	9	40.9 *	10	45.5 *	22 *	100.0
Group 9	5	18.5	6	22.2	8	29.6	8	29.6	27 *	100.0
Group 10	3	13.1	3	13.1	8	34.8	9	39.1 *	23 *	100.0
Group 11	6	16.7	7	19.4	11	30.6	12	33.3	36 **	100.0
Group 12	6	18.8	7	21.9	9	28.1	10	31.2	32 **	100.0
Group 13	4	16.7	5	20.8	7	29.2	8	33.3	24 *	100.0
Group 14	5	13.2	7	18.4	13	34.2	13	34.2	38 ***	100.0
Total	62	16.9	75	20.5	108	29.5	121	33.1	366	100.0

Statistical comparisons between the group 1 and the other groups: \* p< 0.05, \*\*p<0.01, \*\*\* p<0.001

sion than workers without special conditions at work (professional noxiousness and special demands). Workers with arterial hypertension have greater prevalence of hypertriglyceridaemia than workers without arterial hypertension (Table 12). Statistical significance exists in comparison with group of workers that work without presence of professional noxiousness and special demands on their work places (group 1).

Prevalence of hypercholesterolaemia and hypertriglyceridaemia raised with the age (Table 13) and with the duration of occupational exposure (Table 14).

According to informations about treatment of work-

ers with arterial hypertension it was fortified that only 14.5% of hypertensive workers respect hygienic and dietary regime continuously, 34.7% intermittently, while more than half of hypertensive workers (50.8%) don't apply mentioned general measures in the treatment of hypertension. Antihypertensive medication is used continuously from only 29.7% of hypertensive workers, intermittently from 58.6%, while 11.7% of workers with arterial hypertension don't use advised medicaments although the necessity exist (Table 15).

Table 10. Coronary risk factors in workers with arterial hypertension

	Workers with arterial hypertension		Workers without arterial hypertension		p
	Number	%	Number	%	
Smoking cigarettes	144	39.3	523	38.5	n.s.
Positive family history for coronary artery disease	105	28.7	389	28.6	n.s.
Hypercholesterolaemia	118	32.2	353	25.9	<0.05
Hypertiglyceridaemia	97	26.5	245	18.0	<0.05
Diabetes mellitus	23	6.3	35	2.6	n.s.

n.s.-nonsignificant difference

Table 11. Prevalence of hypercholesterolemia in the studied groups

Studied groups	Workers with arterial hypertension			Workers without arterial hypertension			Total		
	n	Number	%	n	Number	%	n	Number	%
Group 1	10	1	10.0	113	3	2.7	123	4	3.3
Group 2	30	8	26.7	94	25	26.6	124	33	24.2 *
Group 3	17	4	23.5	102	17	16.7	119	21	17.6 *
Group 4	29	10	34.5	95	32	33.7	124	42	33.9 **
Group 5	20	4	20.0	102	21	20.6	122	25	20.5 *
Group 6	31	14	45.2	87	34	39.1	118	48	40.7 **
Group 7	27	11	40.7	97	40	41.2	124	51	41.1 **
Group 8	22	3	13.6	97	7	7.2	119	10	8.4
Group 9	27	8	29.6	98	24	24.5	125	32	25.6 *
Group 10	23	5	21.7	96	18	18.7	119	23	19.3 *
Group 11	36	15	41.7	93	34	36.6	129	49	37.9 **
Group 12	32	14	43.7	91	38	41.8	123	52	42.3 **
Group 13	24	6	25.0	100	22	22.0	124	28	22.6 *
Group 14	38	15	39.5	94	38	40.4	132	53	40.2 **
Total	366	118	32.2	1359	353	25.9	1725	471	27.3

Statistical comparisons between the group 1 and the other groups: \* p<0.05, \*\* p<0.01

Table 12. Prevalence of hypertriglyceridemia in the studied groups

Studied groups	Workers with arterial hypertension			Workers without arterial hypertension			Total		
	n	Number	%	n	Number	%	n	Number	%
Group 1	10	1	10.0	113	1	0.9	123	2	1.6
Group 2	30	7	23.3	94	17	18.1	124	24	19.4 *
Group 3	17	3	17.6	102	10	9.8	119	13	10.9 *
Group 4	29	9	31.0	95	27	28.4	124	36	29.0 **
Group 5	20	4	20.0	102	13	12.7	122	17	13.9 *
Group 6	31	13	41.9	87	29	33.3	118	42	35.6 **
Group 7	27	10	37.0	97	29	29.9	124	39	31.5 **
Group 8	22	1	4.5	97	4	4.1	119	5	4.2
Group 9	27	6	22.2	98	16	16.3	125	22	17.6 *
Group 10	23	3	13.0	96	10	10.4	119	13	10.9 *
Group 11	36	12	33.3	93	25	26.9	129	37	28.7 **
Group 12	32	11	34.4	91	26	28.6	123	37	30.1 **
Group 13	24	5	20.8	100	15	15.0	124	20	16.1 *
Group 14	38	12	31.6	94	23	24.5	132	35	26.5 **
Total	366	97	26.5	1359	245	18.0	1725	342	19.8

Statistical comparisons between the group 1 and the other groups: \* p<0.05, \*\* p<0.01

Table 13. Prevalence of hypercholesterolemia and hypertriglyceridemia according to the age of examined workers

Age (years)	N	Hypercholesterolemia		Hypertriglyceridemia	
		Number	%	Number	%
20-30	342	39	11.4	13	3.8
31-40	340	51	15.0	24	7.1
41-50	353	98	27.8 **	63	17.8 **
51-60	344	131	38.1 **	101	29.4 ***
61-65	346	152	43.9 ***	141	40.7 ***
Total	1725	471	27.3	342	19.8

Statistical comparisons between the age group 20-30 years and the other age groups: \* p<0.05, \*\*p<0.01, \*\*\*p<0.001

Table 14. Prevalence of hypercholesterolemia and hypertriglyceridemia in industrial workers according to the duration of exposure

Duration of occupational exposure (years)	N	Hypercholesterolemia		Hypertriglyceridemia	
		Number	%	Number	%
Under 10	395	72	18.2	31	7.8
11-20	441	98	22.2	58	13.1 *
21-30	451	127	28.2 *	119	26.4 **
31-45	438	174	39.2 **	134	30.6 ***
Total	1725	471	27.3	342	19.8

Statistical comparisons between the exposure group under 10 years and the other exposure groups: \* p<0.05, \*\*p<0.01, \*\*\*p<0.001

## Discussion

The results of this research showed that 21.2% of industrial workers had arterial hypertension. This is harmonize with results from the similar research in Italy (10). It was fortified that prevalence of arterial hypertension in age group from 20 to 30 years is 5.4% at men and 5.7% at women, and the frequency of arterial hypertension raises with oldness of examined workers, which is the same as the our previous studies (11).

It was found that 11.5% of examined workers have diastolic blood pressure between the 85 and 89 mmHg). This information deserve special attention because results of many studies show that enlargement of morbidity and mortality in booth sexes is related directly with increase of diastolic pressure over 85 mmHg (12,13, 14). The risk for beginning of coronary heart disease is significantly higher at hypertensive workers older than 45 years, which have diabetes, hypercholesterolaemia, smoke cigarettes habits, over weight people and persons that are less physically active on their work place. There are arguments that are harder to normalize blood pressure at such people as previously mentioned (15).

The results of this study show that arterial hyperten-

sion, hypercholesterolaemia and hypertriglyceridaemia can be find more often at workers which work at shifts, nightly, in norm and on work places with proved professional noxiousness (noise, lead vapors). This harmonize with the results of studies of other authors who have found more frequent appearance of arterial hypertension at workers professionally exposed to noise (16), to lead (17), which work in shifts and nightly (18,19). It was found that workers who work in norm, at night and with presence of noise, significantly more often have higher values of cholesterol and triglycerids, which is similar at studies of other authors (20,21,22) and with the our previous studies (23,24). This information can be explained with influence of mentioned noxiousness on neuro-endocrine system and disturbances of circadian rhythm of exposed workers. This can bring faster beginning of arterial hypertension and disturbance of fat's metabolism at exposed workers (16,25,26). The significant increase of plasma cholesterol and triglycerides concentrations in workers exposed to professional noxiousness are considered important observations of this study, because of their pathogenetic implications. These effects are compatible with the lipolitic action of adrenergic overactivity caused by the action of professional noxiousness (17, 22,23). The adrenergic overactivity may increase the mobilisation of plasma free fatty acids from adipose tissue and formation of triglycerides and cholesterol, integrating the lipoproteins. These modifications in the blood lipids and the elevation of blood pressure found in this study may exert a pathogenetic action on cardiovascular system, where they may accelerate atherosclerosis. Also, chronically increased blood lipids plus the direct cardiotoxic effects of epinephrine and norepinephrine can lead to degenerative changes in the myocardium.

This study showed that small number of patients with arterial hypertension acted to harmonize with suggested therapy and advises. According to informations of other authors, only half of hypertensive people get treatment, and among them only one half get proper treatment (1,27). It is very important to notice that less than half registered hypertensive workers respect hygienic and dietary regime of life and nutrition. As the researches proved, general measures presented very important part of blood pressure treatment, and also prevention of complications (12,28). The reasons of disrespect, of the prescribed therapy must be examined.

## Conclusion

We believe that arterial hypertension in working population present a significant medical problem. Professional noxiousness (noise, lead vapors) special de-

Table 15. Data about the treatment of hypertensive workers

Type of treatment	Prescribed therapy and recommended advise		Behave to harmonize the prescribed therapy and advise					
			No		Yes, always		Yes, occasionally	
	Number	%	Number	%	Number	%	Number	%
Hygienic and dietary regime	366	100	186	50.8	53	14.5	127	34.7
Antihypertensive medicaments	273	100	32	11.7	81	29.7	160	58.6

mands of work (shift work, night work, work in norm) and various combinations of them with simultaneous effects can be a contributing factors in developing of

arterial hypertension, hypercholesterolaemia and hypertriglyceridaemia at exposed workers.

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## KARAKTERISTIKE ARTERIJSKE HIPERTENZIJE U INDUSTRIJSKIH RADNIKA

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*Kratak sadržaj: Arterijska hiperenzija je problem od socijalnog, medicinskog i ekonomskog značaja. Cilj ovog rada je da ispita prevalenciju i epidemiološke karakteristike arterijske hipertenzije u grupi od 1725 industrijskih radnika na području regiona Niš. Ispitivani su radnici tekstilne, duvanske, hemijske, metaloprerađivačke industrije, štamparije i*



*građevinarstva. Zavisno od noksi na radnom mestu i zahteva radnih mesta radnici su podeljeni u 14 podgrupa.. Nije bilo statistički značajnih razlika u prisustvu ostalih faktora koji mogu uticati na pojavu arterijske hipertenzije osim faktora profesionalne ekspozicije. Utvrđeno je da prevalencija arterijske hipertenzije iznosi 21,2%. Radnici profesionalno izloženi buci, olovnim isparenjima, radu u smenama, noćnom radu češće pate od arterijske hipertenzije u odnosu na grupu radnika koji nisu izloženi ovim noksama i zahtevima radnih mesta. Hiperholesterolemija i hipertrigliceridemija su statistički značajno češće kod hipertenzivnih radnika izloženih buci, noćnom radu, radu u smenama i radu u normi gde je i učestalost arterijske hipertenzije statistički značajno veća. Mali procenat radnika sa arterijskom hipertenzijom poštuje preporuke doktora medicine u vezi terapije i prevencije komoplukacija. Smatramo da je arterijska hipertenzija značajan medicinski problem u industrijskoj populaciji i da nokse na radnom mestu i zahtevi radnih mesta mogu favorizovati češću pojavu ove bolesti.*

*Ključne reči: Industrijski radnici, arterijska hipertenzija, profesionalne nokse*

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