

Influence of a physical exertion on the workers' health state

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Abstract

Purpose: The health state of the workers employed at hard and very hard workplaces (on the ground of an energy expenditure measurement) has been presented in this report.

Material and methods: The morbidity of these workers was compared with the morbidity rates of two groups: the persons employed at a factory management and the workers performing light and moderate physical work. The number data has been standardized in order to eliminate the influence of an age over the morbidity rate values.

Results: A number of the considerably differences in frequency of the occurrence of each disease among the examined employees groups has been found.

Conclusion: The diseases of the peripheral nervous system and locomotive organs as well as the disturbances of the cerebral circulatory were of more frequent occurrence among the persons performing hard and very hard work.

Key words: epidemiology, physical exertion, health state.

Introduction

The technical progress in many branches of the industry limited considerably a physical effort, particularly its dynamic component. However, not everywhere is possible a total automatization of production. On the other side making the processes of the production more modern causes the efficiency's

increase, which is related to growth of its rate, which in turn causes that work is harder.

The physical effort extend, which is connected to a functional equilibrium, i.e. homeostasis, is characteristic of every person. It is a submaximal effort. Efficiency in taking this kind of effort is the bigger the bigger is the efficiency of a respiratory system and a circulatory system. The maximal effort which exceed organism's functional equilibrium leads to progressive changes in organism's reactions [1-3].

Regardless of age, sex and physical ability there is the linear dependence between the increase of oxygen consumption and the effort value. Simultaneously, independently to the mentioned before factors, there is a linear dependence between oxygen consumption and the minute heart volume, and the same between effort value and minute heart volume. Stroke volume reach its maximal level when the oxygen consumption is about 30% of the maximal ability of the oxygen absorption by human's organism. Increasing heart minute volume above this value is mainly achieved by increasing the of heart rate [1].

On the ground of many researches it was settled that 8 hours of work is not to big workload for a worker when the energy expenditure counted for work – day is lower than 30% of the individual maximal organism's possibilities. Crossing over this possibilities leads to the oxygen debt with all consequences to the health [3,4].

Results of many researches point at the meaning of the level of physical efficiency as a protective factor in the pathomechanism of circulatory system diseases development [5-8].

Low back pain is understand as a morbid complex with a different etiology and pathogenesis, which common symptom is low spine pain. In the contemporary society they are not only the serious health problem but also the social and the economic problem. In the work medicine this problem is mainly concerned with people whose work is connected with factors that cause or intensify low back pain. Here can be mentioned: a hard physical work, changing atmospheric conditions, an affected body position during the work, sitting work and also exposure of vibration [9-11].

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Table 1. Occurrence of the diseases among two workers groups (hard and very hard physical work against mental work) – the age specific and age standardized morbidity

Diseases categories	Hard manual work		Mental work		Chi ²	Differences p<0.05	ASM	
	n	%	n	%			Hard manual work	Mental work
Circulatory system	78	22.3	59	34.3	8.49	s	26.4	30.3
Arterial hypertension	41	11.7	40	23.3	11.52	s	15.9	14.8
Ischemic heart	27	7.7	18	10.5	1.09	ns	9.1	7.8
Disturbances of cerebral circulatory	11	3.2	4	2.3	0.28	ns	4.0	2.0
Respiratory system	28	8.0	11	6.4	0.44	ns	9.5	5.7
Digestive system	51	14.6	45	26.2	10.23	s	17.3	23.2
Chronic gastric and duodenal ulcer	25	7.4	20	11.6	3.05	ns	8.5	10.3
Endocrine glands and metabolic	67	19.2	47	27.3	4.45	s	22.8	24.1
Thyroid gland	26	7.4	14	8.1	0.08	ns	8.8	7.2
Hyperlipidemia	29	8.3	28	16.3	7.51	s	9.8	14.4
Peripheral nervous system	45	12.9	12	7.0	4.14	s	15.3	6.2
Musculo-osseous system	77	22.1	33	19.2	0.57	ns	26.2	17.0
Discopathy	38	10.9	13	7.6	1.45	ns	12.9	6.7
Neurosis	31	8.9	16	9.3	0.02	ns	10.5	8.2
Neoplasms	8	2.3	7	4.1	1.30	ns	2.7	3.6
Employed with diseases – total	218	65.5	117	68.0	0.75	ns	66.6	60.1
Employed – total	349		172		-			

ASM – age standardized morbidity (standard – the general population); s – significant; ns – nonsignificant

The goal of this paper was the estimation the influence of different kinds of work on the health condition of workers employed at one of the ceramic factories.

Material and methods

The examinations were performed in 1020 workers (714 women, 306 men) employed at one of the ceramic factories. They were between 19 and 64 years old (mean 35.8±9.9 years). Most of the workers (848 persons) were employed at physical work, the others persons (172) were working at mental work (management).

The level of the workload was examined on the basis of the amount of the energy expenditure [4,12].

The method of indirect calorimetry [4,13] was used to measure the energetic level during the fundamental works on 99 work places. This method consists of the minute ventilation quantification by the meter of energy expenditure WE – 4, elaborated by Centralny Instytut Ochrony Pracy in Warsaw. Time of every measurement was about 10 minutes. The energy expenditure of the auxiliary work (arrangement, cleaning) and breaks during the work was quantified by the tabular method [4,14]. The researches of energy expenditure were preceded by detailed timing of work shift. The total energy expenditure was presented in net values of the effective professional work, after the deduction of the basal metabolism [4,13]. Calculations were standardized on the weight of 70 kilograms for men and 60 kilograms for women [146].

The workplaces on which total energy expenditure exceeded 1500 kcal (6300 kJ) for men and 1000 kcal (4200 kJ) for women were qualified as a hard and very hard work [12].

Evaluation of the health condition was made on the ground

of general and specialistic medical examinations (subjective and objective) and laboratory tests.

The morbidity of workers employed at hard and very hard workplaces was compared with the morbidity rates of two groups: the persons employed at a factory management and the workers performing light and moderate physical work. The number data has been standardized in order to eliminate the influence of an age over the morbidity rate values.

Results

In the *Tab. 1* there were compared frequency of incidence of chronic illnesses among workers employed on work positions connected with hard and very hard physical work with morbidity rates of mental workers (factory management workers). Among the first group of workers (hard and very hard work) the occurrence of peripheral nervous system diseases was observed statistically more frequent (p<0.05). It was similar with respiratory system diseases, musculo-osseous system (especially spine) diseases and disturbances of the cerebral circulatory like headache and vertigo, but the differences were non significant. Other circulatory system diseases, digestive system diseases, endocrine glands and metabolism diseases occurred more frequent among mental workers. This relationships are more visible for standardized coefficients.

There were also differences in frequency of occurrence of chronic illnesses among workers performing hard or very hard physical work and workers performing light or moderate physical work (*Tab. 2*). Among the first group (hard and very hard work) some of the circulatory system diseases like ischemic heart disease, disturbances of the cerebral circulatory or spine diseases (discopathy) occurred statistically more frequent (p<0.05). Among these workers also occurrence of other musculo-osseous

Table 2. Occurrence of the diseases among two workers groups (hard, very hard physical work against light and moderate work) – the age specific and age standardized morbidity

Diseases categories	Hard manual work		Light and moderate work		Chi ²	Differences p<0.05	ASM	
	n	%	n	%			Hard manual work	Light and moderate work
Circulatory system	78	22.3	139	27.9	3.27	ns	26.4	26.6
Arterial hypertension	41	11.7	61	12.2	0.04	ns	15.9	11.6
Ischemic heart	27	7.7	22	4.4	4.18	s	9.1	4.2
Disturbances of cerebral circulatory	11	3.2	4	0.8	6.53	s	4.0	0.7
Respiratory system	28	8.0	47	9.4	0.50	ns	9.5	9.2
Digestive system	51	14.6	77	15.4	0.11	ns	17.3	14.7
Chronic gastric and duodenal ulcer	25	7.4	41	8.2	0.22	ns	8.5	7.8
Endocrine glands and metabolic	67	19.2	103	20.6	0.27	ns	22.8	19.6
Thyroid gland	26	7.4	34	6.8	0.13	ns	8.8	6.5
Hyperlipidemia	29	8.3	26	5.2	3.25	ns	9.8	5.0
Peripheral nervous system	45	12.9	62	12.4	0.04	ns	15.3	11.8
Musculo-osseous system	77	22.1	93	18.6	1.50	ns	26.2	17.7
Discopathy	38	10.9	34	6.8	4.39	s	12.9	6.5
Neurosis	31	8.9	28	5.6	3.39	ns	10.5	5.3
Neoplasms	8	2.3	7	1.4	0.94	ns	2.7	1.3
Employed with diseases – total	218	65.5	299	59.9	0.14	ns	66.6	57.1
Employed – total	349		499		-			

ASM – age standardized morbidity (standard – the general population); s – significant; ns – non significant

system diseases, peripheral nervous system diseases, thyroid diseases, hyperlipidemia, neurosis and tumors were more frequent but differences were statistically non significant ($p < 0.05$).

Discussion

Hard physical work and at the same time lack of physical activity like sport and also low physical efficiency are the factors which are conducive to more frequent occurrence of ischemic heart disease [15]. It was found, that percentage of people with risk factors of this disease (obesity, arterial hypertension and others) was the highest among these people who worked hard and did not make a sport and the lowest among people who worked hard but also made a sport [16-18].

Realized in our country analysis of the relation between ischemic heart disease factors and education level or workplace in researches POL-MONICA in Warsaw showed, that in Polish population and also in western countries is observed the tendency of decreasing the threat of heart diseases but mostly among people with higher education and higher property qualification [17]. Therefore physical workers become a group at increased risk of circulatory system diseases because of cumulation of many unfavourably influencing factors like: hard physical work, static effort, lack of extraprofessional physical activity, slight and quickly decreasing physical efficiency. In this professional group there are more people smoking, drinking and eating irrationally [17-19].

Despite of many investigations there is no answer on the question, if hard physical work in occupational work can

be taken similarly as a extraprofessional physical activity, as a independent factor reducing risk of heart disease. In the cross-sectional study it is indicated positive influence of physical activity in the occupational work on risk factors of ischemic heart disease [20]. It was also indicated that this kind of activity does not prevent and does not increase the risk of cardiac infarct, however, it increase the risk of general mortality.

It is indicated in our research, that in tested group of employees doing hard and very hard manual work in comparison with employees performing light and moderate manual work, spondylopathy and some of circulatory system diseases like ischemic heart disease or disturbances of the cerebral circulatory occurred statistically more frequent. Disturbances of the cerebral circulatory, spondylopathy had also higher morbidity rates in the group of working hard and very hard in comparison with factory management workers, but differences were statistically non significant.

Conclusions

1. For employees performing hard and very hard physical work the morbidity rate connected with peripheral nervous system diseases was higher in comparison with the morbidity rate for mental workers.

2. In group of employees doing hard and very hard manual work the spondylopathy and some of circulatory system diseases like ischemic heart disease or disturbances of the cerebral circulatory occurred statistically more frequent than at employees performing light and moderate manual work.

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