DETERMINATION OF ADMISSIBLE WORKLOAD LEVELS FOR POSTMEN

A. Bortkiewicz, E. Gadzicka, T. Makowiec-Dąbrowska

Institute of Occupational Medicine, 90-950 Łódź, 8 Teresy st., Poland

INTRODUCTION

The problem of strenuous tasks among postal workers has recently become the subject of concern in Poland. So far no guidelines have been developed regarding the admissable workload levels for postmen. The existing rules and regulations concerning the lifting and shifting of heavy weights are general and not applicable to the specific tasks of the postmen's work. In Poland no studies on workload in postmen have been carried out up to the present. The world literature also does not report much on the subject. Attention is paid mainly to accidents at work and robberies by assault on postmen (1). The few studies on workload in postmen were not intended for determining admissible workload levels (2, 3, 4, 5). In order to fill this gap we have undertaken research into the factors of the postmen's workload to evaluate their influence on the magnitude and effects of this type of work.

MATERIALS and METHODS

Before the study protocol was designed the mailbags of 158 postmen had been weighed every day during a one month period. During this one month period there were days when the workload was light (I), moderate (II) and heavy (III). Therefore, the study was conducted three times for a given subject. The field studies concerned observation and analysis of the postmen's tasks (this was a basis for calculating total worktime for each subject, duration of field work, number of floors in the buildings where the post is delivered, number of registered letters and postal money orders delivered directly to the addressee), 24-hour ECG recording, ambulatory blood pressure monitoring and measurements of the distance covered by postmen at work.

Each subject had the following performed before the field study: subjective and objective medical examination, resting ECG and questionnaire study oriented towards the risk factors and presence of ischaemic heart disease. The subjects of the study were 12 postmen, aged 24-48 (mean 37.8 ± 7.2) with a work history of 1-23 years (mean 8.1 ± 5.9). Among this group there were only 3 female subjects, which was due to the employment structure. None of the subjects had arterial hypertension or cardiovascular diseases. Resting ECG revealed atrio-ventricular (A-V) block I^0 in 1 subject and left ventricular hypertrophy also in 1 subject.

Holter 24-hour ECG monitoring was carried out using Oxford Medilog 3000 system (Oxford, England). The recordings were made from two pre-cordial leads CS_1 and CM_5. During the entire period of registration the examined workers completed activity diaries. The recordings were evaluated automatically at a tape speed 60 times as fast as during the recording, verified visually and then evaluated according to the criteria adopted at the 3rd Holter Symposium in Vienna in 1988.

Heart rate during work-time (HRwork), at home (HRhome) and night-time (HRsleep) were also calculated. Moreover, the following parameters were calculated:
1. Ratio of heart rate = (HRwork/HRmax) * 100%.

HRmax was calculated according to the formula: HRmax = 220-age
2. The relative heart rate (% HR) i.e. the percentage of heart rate reserve, calculated according to the formula (7):

% HR = (HRwork-HRsleep)/(HRmax-HRsleep) * 100%

HRwork, HRwork/HRmax and %HR parameters allow the assessment of cardiovascular response to work as well as the classification of workload (7).

Blood pressure was monitored using Medilog ABP (Oxford). The measurements were taken automatically, every 15 min. during occupational activity, every half hour during leisure-time and every hour during sleep (about 60 measurements in total). The mean systolic and diastolic blood pressures for the 24-h period and respective day-time and night-time activities were calculated. The reference values were Staessen's standards for arterial blood pressure (8).

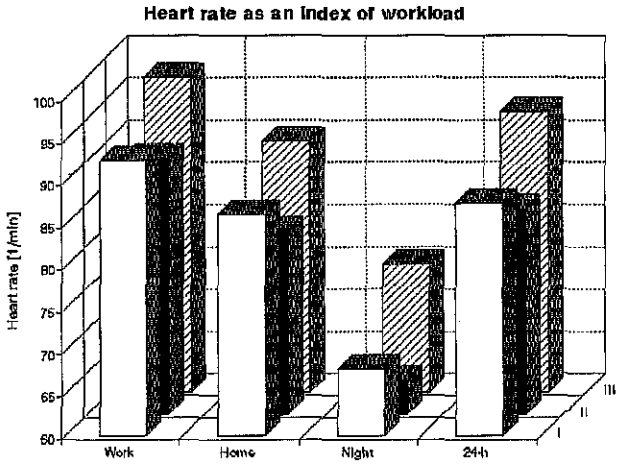
In order to compare the mean values of continuous variables (period of work, duration of field work, distance traveled at work, mailbag's weight, heart rate, and BP recorded on particular days of the study (I, II, III) analysis of variance with multiple comparison tests was applied. Multiple regression analysis was made, with total worktime, duration of field work, number of floors to be traveled and mailbag's weight as independent variables (i), and the parameters of cardiovascular response to workload (heart rate and blood pressure) as dependent variables (d). When the relationship was not linear, we tried to find hypothetical curves describing the relationship between workload parameters and strain.

RESULTS

The mean postmen's worktime was found to be about 9.5 hours; however, it varied depending on the day of the study. On the days when the workload was light and moderate it amounted to about 8.9 hours, whereas on the heavy workload day it could reach 10.5 hours. In the latter case the postmen's worktime was significantly longer than on all the other days and exceeded the statutory 8 hours (9.3-12.0 hours). The mean duration of field work amounted to 5.5 hours; on the days with light and moderate workload - to approx. 5 hours, while on the heavy workload day it was significantly longer and amounted to 6.5 hours. The mean mailbag's weight was 9.2 kg and differed significantly according to the workload level: on the light workload day it was 5 kg, moderate - 9 kg, and heavy 13.6 kg. During a working day the postmen climbed totally from 14 to 350 floors, mean 66 floors. The number of floors traveled during field work amounted to 37 on the day with light workload, to 44 - with moderate workload and to 115 - on the day with heavy workload.

The analysis of 24-hour ECG monitoring revealed that on the light workload day (I) 24-h HR was 87.6±6.3, on moderate (II) - 84.3±8.3 and on heavy (III) - 93.2±8.6. The 24-h HR on the day III was found to be significantly higher ($p=0.05$) than on the day II. HRwork on day I reached 92.7±7.2, day II - 90.4±9.4, and on day III - 97.4±10.4. The differences were not statistically significant. The HRhome did not vary across particular day types. It is worth noticing, however, that HRsleep was significantly higher after day III as compared to day II and I (75.1±7.8,

64±6.9, and 68±6.5 respectively). This would imply a significantly high level of workload, the effects of which can still be found during the night-time (see Fig.).



In 2 subjects on day II and 4 on day III repolarization disturbances attributable to myocardial ischaemia were detected. Such reaction to workload indicates poor tolerance of the load as a result of insufficient blood supply to the cardiac muscle (9).

Mean value of ratio of heart rate (HRwork/HRmax) on all the day types fell within the range of 50-60%, which proves that the occupational activities were highly loading for the organism. No significant differences between particular day types could be found. However, there were significant individual differences with respect to the workload tolerance. Mean value of relative heart rate (% HR) seems to indicate a moderate workload in the group under study. The individual findings, however, differ to an even higher extent and thus the results should be interpreted separately for each subject.

The mean systolic and diastolic blood pressure values for the 24-hour period and for particular day types fell within the standard range for long-term monitoring (8). The ratio between night-time and day-time blood pressures was normal (night-time lowering of BP >10%). No significant differences were found with regard to the blood pressure values in relation to the level of workload. As revealed by the analysis of ABP monitoring in 1 subject the mean 24-hour blood pressure slightly exceeded the normal value, whereas in 4 subjects the traits of hypotension were detected. One of the subjects presented decreased systolic and elevated diastolic BP.

The studies revealed that the level of workload in postmen is determined by many factors. However, it was found, that only two workload parameters were significant in the multiple regression: total worktime and duration of field work. Other workload parameters were not present in the multiple regression, which indicates that there may not be any correlation between workload parameters (i) and physiological indices of load (d) or that the relationship is not linear. In order to check the above, we tried to find hypothetical curves describing the relationship between workload parameters and strain. According to the shape of the curves, heart

rate and relative heart rate were increasing as the mailbag's weight increased within the range from 5-13 kg. Similar reaction refers also to arterial blood pressure, both systolic and diastolic according the mailbag's weight above 15 kg. The decrease in heart rate and blood pressure according to the increasing workload (weight of the mailbag's weight above 13-15 kg) in this case was probably connected with changes of organization of field work during the day with heavy workload. Explanation on this unexpected nonlinear relationship between physiological parameters and workload measures among postmen's requires further detail study.

CONCLUSIONS

As evidenced by the study results, one of the major determinants of workload in postmen is the worktime (which in many cases may exceed the 8-hour standard even by 50%). This indicates a need to reduce the areas covered by a single postman. Thus the mailbag's weight would also decrease; presently it often exceeds 20 kg. The introduction of special carts for carrying the post, which are commonly used abroad, is very difficult in Poland and does not resolve the problem of excessive worktime.

REFERENCES

1. Jortay, A., de-Jonghe, C., Hallot R. 1986, A study on health consequences of holdups in Post Offices. Proceedings of the Conference on the Meaning of Occupational Mental Health in 1986, September 2-5, Houthalen, Belgium, International Committee on Occupational Mental Health, 11.
2. Ilmarinen, J., Louhevara, V. Oja P. 1984, Oxygen consumption and heart rate in different modes of manual postal delivery. Ergonomics 27, 331-339.
3. Oja, P., Louhevaara, V., Korhonen, O. 1977, Age and sex as determinants of the relative aerobic strain of nonmotorized maildelivery. Scandinavian Journal of Work Environment and Health, 225-233.
4. Bloswick, D., Gerber, A., Sebesta, D., Johnson, S., Mecham, W. 1994, Effect of mailbag design on musculosceletal fatique and metabolic load. Human Factors, 36, 210-218.
5. Mital, A., Nicholson, A., Ayoub, M. 1993, A guide manual materials handling. (Taylor & Francis, London, Washington DC)
6. Makowiec-Dąbrowska, T., Bortkiewicz, A. 1990, The relationship between psyhic workload and cardiovascular response in industrial men managers. Polish Journal of Occupational Medicine, 3, 323-332.
7. Makowiec-Dąbrowska, T. 1994, Stress and strain during work among women performing different work task.International Journal of Occupational Medicine and Environmental Health, 7, 323-343.
8. Staessen, J., Fagard, R., Lijnen, P., Thijs, L., Van Hoof, R., Amery, A.1990, Reference values for ambulatory blood pressure: a meta- analysis. Journal Hypertension 8 (suppl 6), S57-S64.
9. Wrabec K. Diagnostic value of exercise testing. 1991, Kardiologia Polska, 33, 185-189.