

AN ERGOMETRIC STUDY AT A VOCATIONAL ASSESSMENT UNIT¹

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ABSTRACT. During a period of 2 years almost all clients (200 men and 74 women) passing through the Vocational Assessment Unit in Göteborg were submitted to a bicycle ergometry test. High heart rates at moderate loads (600 kpm/min), indicating low physical working capacity, were found in most clients below 50 years age, especially those with mental disorders. The highest load that could be sustained for 6 minutes (W_{max}) was low in all the diagnosis groups. The determination of W_{max} is in some respect considered a behaviour test. Physical training seems to be desirable for a large fraction of the patients admitted to the Unit.

Ergometric tests have been performed in almost all clients passing through the Vocational Assessment Unit in Göteborg during a period of two years. The examination sometimes also included spirometry and measurement of the maximum isometric muscle strength. Electrocardiogram (ECG) and heart-rate registration by telemetry was performed—particularly in persons with cardiovascular diseases—in order to evaluate the reaction in various practical job situations.

MATERIAL AND METHODS

Altogether 200 men and 74 women aged between 17 and 60 years were examined. All but 32 of the men belonged to one of the diagnosis groups in Fig. 1; the exceptions had uncommon diagnoses.

The exercise test was performed with a stepwise increase in work loads on a mechanically braked bicycle ergometer (Monark); the "maximum" work load that could be sustained for 6 minutes was determined. An electrocardiogram with extremity leads and 5 unipolar chest leads (CR-load) was recorded on a direct-writing recorder (Mingograf) before, during and after exercise. Heart rate and respiratory rate were measured at the various exercise loads.

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² kpm = kilopond-meter; 1 kp is the force acting on the mass of 1 kg at normal acceleration of gravity (100 kpm/min = 16.35 W).

RESULTS AND DISCUSSION

Fig. 1 shows the means \pm s.d. for the highest work load that could be sustained for 6 minutes (W_{max}) in the most common diagnosis groups. For a group aged 20-29 years Andersen (1) found a mean of 1300 kpm/min² for W_{max} , and a decrease of 100 kpm/min per decade. For a group of women aged 20-29 years the mean was 900 kpm/min, with a similar decrease with age.

W_{max} was found to be low in all the diagnosis groups of the present study, especially in mental deficiency, psychosis, diseases of the nervous and circulatory systems (mainly ischaemic heart disease) and alcohol addiction.

The mean heart rate \pm 1 s.d. at 600 kpm/min is also given in Fig. 1, and, for comparison, the mean \pm 1 s.d. for a group of healthy men 20-65 years of age (5). All the groups at the Vocational Assessment Unit showed a higher heart rate than the controls. This difference was especially large for all the groups with mental disorders.

The individual heart rates at 600 kpm/min are shown for men and women in Figs. 2 and 3, respectively. All but one of the 48 men below 28 years had a higher heart rate than the mean for the control group. For the 50-60-year group, however, the values were distributed fairly uniformly about the mean for the controls.

Most of the young clients had mental deficiency and they had very low physical working capacity. The 30-50-year group consisted mainly of persons with other mental disorders such as psychosis, neurosis, psychopathy and brain damage, and the physical working capacity was low in them, too. The 50-60-year group was composed of persons with alcohol addiction, heart diseases and low back pain (locomotor system included in the diagnosis in Fig. 1).

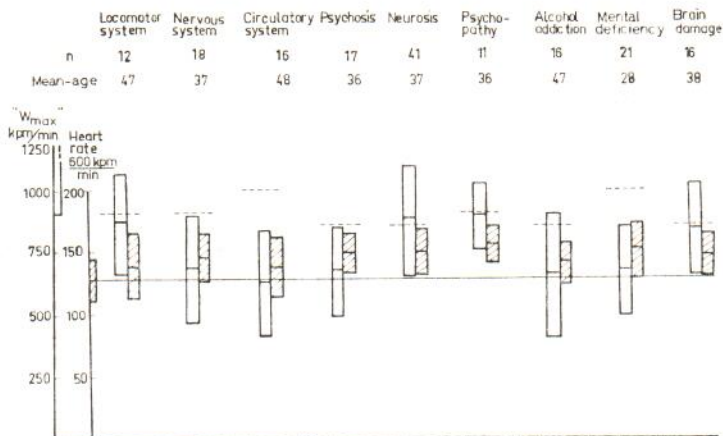


Fig. 1. Means ± 1 s.d. for W_{\max} (open fields) and heart rate (hatched fields) at 600 kpm/min for the various male diagnosis groups. W_{\max} , corresponding to the maximum oxygen uptake predicted from the heart rate at 600 kpm/

min, is shown as broken horizontal lines. On the left, the normal ranges for W_{\max} and heart rate (± 1 s.d.) are given.

The maximum working capacity (maximum oxygen uptake) was also calculated on the basis of the heart rate at 600 kpm/min with the use of the nomogram drawn by I. Åstrand (6) from results obtained in healthy subjects (correlation for age was made). The large discrepancy between observed and predicted W_{\max} (see Fig. 1) for the group "circulatory system", which consisted chiefly of patients with ischaemic heart disease, may be ascribed to cessation of the exercise test by chest pain, arrhythmia or ECG signs of coronary insufficiency. An abnormal ECG before, during and/or after exercise was recorded in 31 men

and 2 women; 19 of them showed abnormal ST-segment changes during exercise. Only 5 had chest pain, and then the exercise test was interrupted; in one case frequent ventricular ectopic beats, in another supraventricular beats and in a third case sinus arrest was noticed. Five persons had ECG signs of an old myocardial infarction and 2 atrial fibrillation.

There was also a large difference between the predicted and observed W_{\max} in mental deficiency, and in "alcohol addiction"; this may have been due to low motivation or decreased muscle strength (4). Diseases of the nervous system often

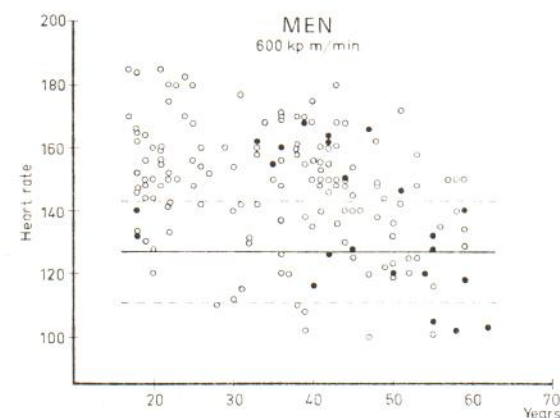


Fig. 2. Heart rate in relation to age for all the men who had performed the exercise test at 600 kpm/min. Filled circles indicate those recording an abnormal ECG before, during or after exercise. The mean ± 1 s.d. for a control group of healthy men is shown (5).

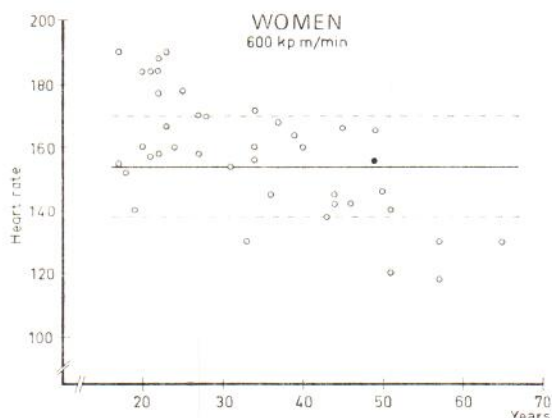


Fig. 3. Heart rate in relation to age for all the women who had performed exercise at 600 kpm/min. Filled circles indicate those recording an abnormal ECG before, during or after exercise. The mean ± 1 s.d. for a control group of healthy women is shown (6).

cause movement disability, with or without pain, which would impede cycling at high loads. Some of the psychotic patients did not co-operate well, owing to the nature of the symptoms.

It is rewarding to compare the results of the exercise tests with the energy requirement for different types of work. In light industrial work about 5 kcal/min is needed (2). According to many recommendations the average energy expenditure during daily work should not exceed 40–50 per cent of W_{max} (6). W_{max} in the present material corresponds to 7–10 kcal/min. This is consistent with the experience at other vocational assessment units, e.g. Asmussen (2). From these figures it might be concluded that many of the persons passing through this Department would hardly be capable of even light industrial work. In fact, we find that in their daily work these persons are sometimes exceeding 40–50 per cent of the maximum capacity, as measured by the ergometric test. In view of the above we consider the W_{max} determination to be in some respect a behaviour test, and to be invalidated by several factors inherent in the diseases. For instance, the observed W_{max} is quite often underestimated, and does not always provide a true measure of the capacity of the oxygen transport system. However, the relatively high heart rate at 600 kpm/min indicates an impaired physical condition, and

physical training seems therefore to be desirable for a large fraction of the patients admitted to the Vocational Assessment Unit.

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