Work load

Workload is a set of influences and factors that affect the organism of a healthy person during the actual performance of work or in the work environment. Work physiology monitors these influences. It seeks the upper limit of the load that an individual can bear without damaging health and without shortening the working age.

Methods of detecting and evaluating energy expenditure at work

1. **Off-road** - it is loaded with error (up to 30%), but does not require complex instrumentation.
2. **Laboratory** - determination of muscle effort by measuring the intensity of lung ventilation (ventilometry), gas exchange in the lungs (indirect calorimetry).

Determination of energy expenditure by indirect calorimetry [edit | edit source]

We measure the minute pulmonary ventilation and determine the concentration of O_2 and CO_2 in the exhaled air . From the minute consumption of O_2 using the respiratory quotient and the energy equivalent, we calculate the amount of energy released (gross). If we want to know the net energy expenditure, we must subtract the value of the basal metabolism (6500 kJ) from the result.

Estimation of energy expenditure according to minute lung ventilation - ventilometry [edit | edit source]

It uses the knowledge that there is a close correlation between ventilation and O_2 consumption . The assumption is that we are observing a healthy person who does not hyperventilate and performs mainly dynamic work, the pulmonary ventilation is in the range of 10-40 liters per minute and the work is performed in conditions that allow easy thermoregulation . Energy expenditure is calculated by multiplying corrected pulmonary ventilation by a factor of 0.837 (expressed in kJ/min.)

Estimation of energy expenditure according to heart rate [edit | edit source]

Heart rate is directly dependent on the intensity of metabolism. In healthy people, an increase in working heart rate by 10 beats per minute represents an energy expenditure of 4.2 kJ. TF measurement methods: palpation method after the end of the activity, auscultation method after the end of the activity, telemetry measurement during the activity.

Estimation of energy expenditure from tabular values [edit | edit source]

Tables of energy expenditure for work allow assessment of workload without more complex measurements. We use the Spitzer–Hettinger tables modified by Žaček. The data from the time frame of the day is multiplied by the corresponding value of the energy expenditure according to the tables. The sum of all values for one working day is the entire shift's energy expenditure. It is necessary to make a time snapshot of the working day as accurate as possible.

Evaluation of the results of measuring energy expenditure at work [edit | edit source]

We evaluate physical exertion according to energy consumption, or the necessary energy expenditure evaluated in MJ (megajoules).

Limit values of energy expenditure per work shift

Women 18–29 years: 5.1 MJ (max. 6.1 MJ allowed), men 8.25 MJ (9.9 MJ allowed). In order to assess the shift load, it is also important to know the periods of rest periods, the frequency of movements, working positions and the solution of the workplace.

Long-term sustainable work

Work energy expenditure does not exceed a value equivalent to 33% VO_2 max, or maximum performance. These jobs can be performed throughout the working age without negative effects on health. This value can occasionally be exceeded for a short time without harmful effects, but at most up to a value equivalent to 70% of VO_2 max and provided that the limit for annual energy expenditure is not exceeded.

Average whole-shift energy expenditure

Work energy expenditure issued on average for one shift in a period of one year, i.e. during 235 working days in a five-day working week.

Permissible full-shift energy expenditure

It is limited by work energy expenditure, which should not exceed a value equivalent to 37% VO_2 max.

Detection and evaluation of thermoregulatory effort

When thermoregulation is necessary, work performance drops significantly, depending on the size of the load and the climatic conditions. During work, considerable heat is generated ; however, heat output lags behind production, especially when working in a hot environment. In such a case, the body temperature increases by 0.5–1.0 °C, sometimes even more, and contributes to fatigue.

Measurement of fluid losses in hot operations

We weigh the worker before the shift and then during the shift we weigh food and drinks, urine and stool. At the end of the shift, we consider the worker a second time. Fluid loss (Z) is calculated from the formula: Z = (V1 + P + N) – (V2 + M + S), where V1 – weight before the shift, P – amount of food taken, N – amount of drinks consumed, V2 – weight after shift, M – amount of excreted urine, S – stool weight (flat rate 150 g). To assess the drinking regime, it is necessary to know the percentage of reimbursement of lost fluids U, which we calculate U = N/ Z x 100 (%).

Evaluation of fluid loss measurement results

We consider working in the heat to be a work process that is a source of such thermal stress that workers lose more than 1 liter of fluids per shift due to it. Fluid loss of more than 3 l per shift corresponds to a greater heat load. Losses of more than 4 l per shift are very serious and force the adjustment of the thermal conditions at the workplace or a change in the work regime. During the shift, liquids should be covered by suitable drinks in the range of 70-85% of the total loss. With losses of up to 3 l per shift, there is no need to add NaCl in an extraordinary manner.

Links

Related articles

- Types of work
- The work of specific groups of people (pregnant women, teenagers, elderly people and people with disabilities) .

References

- BENCKO, Vladimír, et al. *Hygiene: Textbooks for seminars and practical exercises.* 2nd revised and supplemented edition of the edition. Prague: Karolinum, 2002. 205 pp. ISBN 80-7184-551-5 .