

Estimation of daily expenditure of energy in student

Adequate intake and expenditure of energy in humans is stable and precisely regulated. If total amount of energy taken in food is equal to total amount of energy expenditure (in the form of work and heat), the body weight doesn't change. If intake of energy is for longer time higher than energy expenditure, the body weight increases = *positive energetic balance*. If intake of energy is for longer time lower than expenditure, the body weight decreases = *negative energetic balance*.

Energy obtained from the food (saccharides, fats, proteins) is stored in various forms and used in many processes (mechanical work, anabolism, membrane transport, transport of information, immunity, thermoregulation, degradation and detoxication of substances etc.).

In basal conditions, i.e. consciousness, mental and physical rest in a supine position, postabsorption status (12-18 hours after last food intake), neutral temperature (15-25 °C), the organism consumes basal amount of energy (i.e. *basal metabolic rate*, BMR).

Amount of consumed energy is dependent on: muscle activity, food intake, temperature, body surface area, gender, age, levels of several hormones etc. During as well as after the *physical activity* is the consumption of oxygen and energy higher, since the organism should compensate oxygen debt. Extent of metabolic processes is directly dependent on the extent of physical activity (Tab. 1).

Consumption of energy increases also after the *food intake*, where it supplies the processes of digestion, resorption and transport of nutrients (specific dynamic effect of the food, SDEF). The highest SDEF is in proteins, which increase BMR of about 30 %, fats and saccharides increase BMR of 5-10 %.

Metabolism rises also in higher *temperature of environment* - fastening the metabolic processes of 10-13 % per each 1 °C of temperature. In lower temperature of environment, metabolism decreases despite activation of thermoregulation mechanisms.

In addition, BMR depends also on the *body weight* and *surface* (norm 104 kJ/kg/day), *gender* (in women lower of 5-7 % than in men), *age* (BMR increases till 6th year of age, then gradually decreases), and *levels of thyroid hormones and catecholamines* (in their increased levels BMR increases, in their lower levels BMR decreases). Consumption of energy elevates also during *pregnancy* and *breast feeding*, as well as after the use of several *drugs* (caffeine, amphetamine, some alcaloids).

Daily consumption of energy may be roughly determined as a sum of all values of energetic expenditure in various daily activities, which may be calculated as multiplication of duration of the daily activity in minutes, BMR/min and coefficient for the individual activity (Table 1), or expenditure of energy in various activities may be directly read from the table (Table 2).

Needs

Tables for calculation of standard basal metabolic rate (SBMR) according to age, gender, height and weight of the person by Harris and Benedict (Table 3, Table 4), table of coefficients of metabolic increase in various activities (Table 1), table of energy consumption in kJ/min and in kJ/h in various activities (Table 2), calculator.

Methods

Using tables for calculation of SBMR (Table 3, Table 4) calculate your value of BMR per 24 hours and per 1 min. Write down the list of all your activities in the last 24 hours into the Table 5 including the duration of each activity in minutes (e.g. personal hygiene 20 min, breakfast 10 min, walking 40 min, study 180 min etc.). The total duration of all daily activities must give the total time of 1440 min.

In Table 1 find the coefficients for individual daily activities and calculate expenditure of energy using a formula: **EE = duration of the activity (in minutes) x c x BMR/min.**

Write down your results into the Table 5. Compare your results with data of energy expenditure in various activities in Table 2.

Table 1. Coefficients of metabolic increase in various daily activities (c).

Activity	coefficient (c)
Sleep	1.0
Lying	1.2
Sitting	1.2
Easy work in sitting (sewing)	1.4
Study, reading	1.3
Standing	1.5
Easy work in standing	1.7
Walking (walking at home, shopping)	2.5
Walking in slow rate	2.8
Walking in middle (normal) rate	3.2
Walking in fast rate	3.4
Walking with load (travel bag)	3.5
Walking up the hill (normal rate)	5.7
Daily hygiene	1.7
Washing dishes	1.7
Work in household – easy	2.7
Work in household – middle (hoovering, sweep)	3.0
Work in household – hard (cleaning windows, floor)	3.7
Ironing	1.4
Babysitting	2.2
Cooking	1.8
Work in laboratory	2.0
Driving a car	1.4
Card playing	1.4
Sport – light effort (snooker, bowling, table-tennis)	3.3
Sport – middle effort (swimming, tennis, dance, skating, aerobic)	5.5
Sport – intensive effort (football, athletics, jogging, cycling)	6.6
Rowing	3.4
Wearing of hard load	3.7
Discharge of hard load	7.4
Painting (room)	2.8
Work of unskilled labourer at building site (intensive effort)	5.2
Bricklayer work	3.3
Work in the garden	3-4.6
Woodcutting	4.1

Table 2. Consumption of energy in various activities and sports

Activity	kJ/min	kJ/h
Basal consumption	4	240
Sitting	5	300
Typing	7,5	450
Driving a car	12	720
Cycling (8 km/h)	19	1140
Swimming (18 m/min)	21	1260
Walking (6 km/h)	23	1380
Dance	30	1800
Tennis (double)	31	1860
Mowing (grass)	32	1920
Basketball	33	1980

