

Calculating Daily Energy Balance

Part I Resting Metabolic Rate

Resting metabolic rate varies depending on age, gender, and weight. Use the equations below to calculate your approximate RMR.

World Health Organization Equations

- Convert body weight to kilograms:
 _____ lb \div 2.2 lb/kg = _____ kg
- Find the appropriate formula in the table below, and calculate your RMR. (For example, a 19-year-old male weighing 80 kg would have an RMR of approximately $(15.3 \times 80) + 679 = 1224 + 679 = 1903$ calories a day.)

Age Range (years)	Equation to Derive RMR in cal/day	
	Males	Females
10–18	$(17.5 \times \text{wt}) + 651$	$(12.2 \times \text{wt}) + 746$
18–30	$(15.3 \times \text{wt}) + 679$	$(14.7 \times \text{wt}) + 496$
30–60	$(11.6 \times \text{wt}) + 879$	$(8.7 \times \text{wt}) + 829$
Over 60	$(13.5 \times \text{wt}) + 487$	$(10.5 \times \text{wt}) + 596$

$$\text{RMR} = \left(\frac{\text{_____}}{\text{(factor from table)}} \times \frac{\text{_____}}{\text{(body weight)}} \text{ kg} \right) + \frac{\text{_____}}{\text{(factor from table)}} = \text{_____ cal/day}$$

Harris Benedict Equations

- Convert body weight to kilograms: _____ lb \div 2.2 lb/kg = _____ kg
- Convert height to centimeters: _____ in. \times 2.54 cm/in. = _____ cm
- Use the appropriate equation to calculate RMR. (For example, a 20-year-old female 160 cm tall, weighing 60 kg, would have an RMR of approximately $655 + (9.56 \times 60) + (1.85 \times 160) - (4.68 \times 20) = 1431$ calories a day.)

$$\text{Women: RMR} = 655 + (9.56 \times \text{weight _____ kg}) + (1.85 \times \text{height _____ cm}) - (4.68 \times \text{age _____ yr}) = \text{_____ cal/day}$$

$$\text{Men: RMR} = 66.5 + (13.8 \times \text{weight _____ kg}) + (5 \times \text{height _____ cm}) - (6.76 \times \text{age _____ yr}) = \text{_____ cal/day}$$

Approximate Resting Metabolic Rate

Average the values you obtained from these equations to determine your approximate RMR.

World Health Organization Equation: _____ cal/day

Harris Benedict Equation: _____ cal/day

Average value for RMR: _____ cal/day

Part II Daily Energy Expenditures

List all your activities for a 3-day period and classify them according to the categories listed in the table below. (Representative values of the calorie costs of different types of activities are presented below as multiples of resting metabolic rate.) Table 7.1 provides general guidelines for how to classify your sports and fitness activities: Activities with high cardiorespiratory endurance ratings probably fall in the heavy category, those with medium CRE ratings in the moderate category, and those with low CRE ratings in the light category. Take your intensity into account when classifying fitness activities; basketball, for example, can be played at an easy pace or intensely.

Your total daily energy expenditure can be estimated by calculating a daily activity factor based on the amount of time you engage in activities in each category of intensity. By adding up weighted activity factors and finding the average, you can calculate total daily energy requirements. Since your activity levels probably vary widely from day to day, it's more accurate to calculate energy output for several days to come up with an average daily range of calorie output.

<i>Activity Category</i>	<i>Representative Value for Activity Factor per Unit Time of Activity</i>
<i>Resting:</i> Sleeping, lying down	RMR \times 1.0
<i>Very light:</i> Seated and standing activities such as driving, lab work, writing, typing, cooking, playing cards, or playing a musical instrument	RMR \times 1.5
<i>Light:</i> Walking on a level surface 2.5–3.0 mph, house cleaning, child care, carpentry, restaurant trades, and sports/activities with low fitness ratings such as golf, bowling, and sailing	RMR \times 2.5
<i>Moderate:</i> Walking 3.5–4.0 mph, gardening, carrying a load, and sports/activities with medium fitness ratings such as baseball and volleyball	RMR \times 5.0
<i>Heavy:</i> Walking with a load uphill, heavy manual labor, sports/activities with high fitness ratings such as aerobic dance and cross-country skiing	RMR \times 7.0

For each day, add up the total number of hours for each activity category. Then multiply the total duration for each category by the category's activity factor. Add the weighted activity factors, then divide the total weighted activity factor by 24 to get an average daily activity factor. A sample of completed calculations for one day is shown below.

SAMPLE

<i>Activity</i>	<i>Duration</i>	<i>Category</i>
sleeping	8 hours	resting
eating in dorm	1-1/2	very light
class	5	very light
bicycling to class, lab...	1	moderate
job in library	2-1/2	very light
cleaning room/laundry	1	light
basketball	1	heavy
studying in library	4	very light

<i>Category</i>	<i>Activity Factor</i>	<i>Duration</i>	<i>Weighted Activity Factor</i>
Resting	1.0	8	8.0
Very light	1.5	13	19.5
Light	2.5	1	2.5
Moderate	5.0	1	5.0
Heavy	7.0	1	7.0
Total		24 hours	42.0
Average daily activity factor (Total of weighted factors \div 24)			1.75

RECORDS FOR 3 DAYS

Day 1

<i>Activity</i>	<i>Duration</i>	<i>Category</i>

Day 1

<i>Category</i>	<i>Activity Factor</i>	<i>Duration</i>	<i>Weighted Activity Factor</i>
Resting	1.0		
Very light	1.5		
Light	2.5		
Moderate	5.0		
Heavy	7.0		
Total		24 hours	
Average daily activity factor (Total of weighted factors ÷ 24)			

Day 2

<i>Activity</i>	<i>Duration</i>	<i>Category</i>

Day 2

<i>Category</i>	<i>Activity Factor</i>	<i>Duration</i>	<i>Weighted Activity Factor</i>
Resting	1.0		
Very light	1.5		
Light	2.5		
Moderate	5.0		
Heavy	7.0		
Total		24 hours	
Average daily activity factor (Total of weighted factors ÷ 24)			

Day 3

<i>Activity</i>	<i>Duration</i>	<i>Category</i>

Day 3

<i>Category</i>	<i>Activity Factor</i>	<i>Duration</i>	<i>Weighted Activity Factor</i>
Resting	1.0		
Very light	1.5		
Light	2.5		
Moderate	5.0		
Heavy	7.0		
Total		24 hours	
Average daily activity factor (Total of weighted factors ÷ 24)			

Day 1 average daily activity factor _____

Day 2 average daily activity factor _____

Day 3 average daily activity factor _____

Finally, use the middle or average of your three daily activity factors to calculate your average daily energy output. For RMR, use the value you calculated in the first part of this lab. (For example, a person with an average daily activity factor of 1.75 and an RMR of 1450 calories a day would have an approximate daily energy expenditure of $1.75 \times 1450 = 2540$ calories per day.)

Average of three daily activity factors _____ \times 3 RMR _____ cal/day
(from Part 1)

5 approximate daily energy expenditure: _____ cal/day

Sources: National Research Council. 1989. *Recommended Dietary Allowances*, 10th ed. Washington, D.C.: National Academy Press. World Health Organization. 1985. *Energy and Protein Requirements: Report of a Joint FAO/WHO/UNO Expert Consultation*. Geneva: World Health Organization, Technical Report Series 724.

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