

Energy Equivalents of Respiratory Gas Volumes for Different RQs (Aerobic Respiration)

RQ	KJ/LO ₂	KJ/LCO ₂	Kcal/LO ₂	Kcal/LCO ₂
0.71	19.62	27.64	4.69	6.61
0.72	19.67	27.32	4.70	6.53
0.73	19.72	27.02	4.71	6.46
0.74	19.78	26.73	4.73	6.39
0.75	19.83	26.44	4.74	6.32
0.76	19.87	26.15	4.75	6.25
0.77	19.93	25.89	4.76	6.19
0.78	19.98	25.62	4.78	6.12
0.79	20.03	25.36	4.79	6.06
0.80	20.09	25.11	4.80	6.00
0.81	20.14	24.86	4.81	5.94
0.82	20.19	24.62	4.83	5.88
0.83	20.24	24.39	4.84	5.83
0.84	20.29	24.16	4.85	5.77
0.85	20.34	23.93	4.86	5.72
0.86	20.40	23.72	4.88	5.67
0.87	20.45	23.50	4.89	5.62
0.88	20.50	23.29	4.90	5.57
0.89	20.55	23.09	4.91	5.52
0.90	20.60	22.89	4.92	5.47
0.91	20.65	22.69	4.94	5.42
0.92	20.70	22.50	4.95	5.38
0.93	20.76	22.32	4.96	5.33
0.94	20.81	22.14	4.97	5.29
0.95	20.86	21.95	4.99	5.25
0.96	20.91	21.78	5.00	5.21
0.97	20.96	21.61	5.01	5.16
0.98	21.01	21.44	5.02	5.12
0.99	21.07	21.28	5.04	5.09
1.00	21.12	21.12	5.05	5.05

Source: Zuntz N. 1901. Ueber die Bedeutung der verschiedenen Nahrstoffe als Erzeuger der Muskelkraft. Pflügers Arch 83: 557.

This table is based on the notion that all RQs between 0.71 (fats only energy substrate) and 1.0 (carbohydrates only substrate) are mixes of lipid and fat metabolism -- i.e., that no protein is being used for energy. This is probably approximately true in many species, especially in resting individuals who are not starving. However, in other conditions and in some species, intermediate RQs may indicate significant protein metabolism and the calculation of energy equivalents is a bit more complicated. Nevertheless, this table generally represents a good approximation for most purposes.

RQ	Kcal/LO ₂	Kcal/LCO ₂	Percent Contribution		Calculation	
			Carbs	Fats	Kcal/LO ₂	Kcal/LCO ₂
0.71	4.69	6.61	0	100	4.69	6.72
0.72	4.70	6.53	5	95	4.70	6.66
0.73	4.71	6.46	8	92	4.72	6.60
0.74	4.73	6.39	12	88	4.73	6.54
0.75	4.74	6.32	16	84	4.74	6.47
0.76	4.75	6.25	19	81	4.76	6.41
0.77	4.76	6.19	23	77	4.77	6.35
0.78	4.78	6.12	26	74	4.78	6.29
0.79	4.79	6.06	30	70	4.79	6.23
0.8	4.80	6.00	33	67	4.81	6.17
0.81	4.81	5.94	37	63	4.82	6.11
0.82	4.83	5.88	40	60	4.83	6.06
0.83	4.84	5.83	44	56	4.84	6.00
0.84	4.85	5.77	47	53	4.86	5.94
0.85	4.86	5.72	51	49	4.87	5.88
0.86	4.88	5.67	54	46	4.88	5.82
0.87	4.89	5.62	58	43	4.89	5.76
0.88	4.90	5.57	61	39	4.90	5.71
0.89	4.91	5.52	64	36	4.92	5.65
0.9	4.92	5.47	68	33	4.93	5.60
0.91	4.94	5.42	71	29	4.94	5.54
0.92	4.95	5.38	74	26	4.95	5.48
0.93	4.96	5.33	77	23	4.96	5.43
0.94	4.97	5.29	81	19	4.98	5.37
0.95	4.99	5.25	84	16	4.99	5.32
0.96	5.00	5.21	87	13	5.00	5.26
0.97	5.01	5.16	90	10	5.01	5.21
0.98	5.02	5.12	94	6	5.02	5.15
0.99	5.04	5.09	97	3	5.03	5.10
1	5.05	5.05	100	0	5.04	5.04

Example:

If we assume that the average energy equivalence for all carbohydrate metabolism is 678 Kcal/mol carb or about 5.045 Kcal/LO₂ and L CO₂ and if we assume that mixed fat metabolism yields about 2415 Kcal/mol fats or 4.688 Kcal/LO₂ and 6.74 Kcal / LCO₂, then, for RQ = 0.85 51% of energy is from carbs and 49% from lipids therefore for O₂:

$$0.51 * 5.045 \text{ Kcal/LO}_2 + 0.49 * 4.688 \text{ Kcal/LO}_2 = 4.87$$

(The slight discrepancy with the value given in the table is due to rounding errors for energy equivalents of a liter of O₂.)