

MEASUREMENT OF DAILY ENERGY EXPENDITURE USING FACTORIAL, INTAKE-BALANCE AND DOUBLY-LABELLED WATER METHODS IN SMOKERS AND NONSMOKERS

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This study investigated whether factorial measures of daily energy expenditure (EE) under-estimate EE in smokers compared with non-smokers.

EE was measured over twenty-eight consecutive days by a simplified factorial method (FEE) (Warwick et al. 1988) and by the intake-balance method (IBEE) (from weighed records of energy intake and changes in body fat assessed from body weight and skinfold thickness). During the 28 day study, EE was measured for twelve days using doubly-labelled water (DEE). Doses of 0.2 g/kg body weight of $H_2^{18}O$ and 0.1 g/kg of 2H_2O were given orally at zero time (10.00 hours). Isotopic enrichments of urine collected prior to the dose (baseline) and between 14.00-16.00 hours on days 0 (equilibrium), 4, 8 and 12, were measured by mass spectrometry. Elimination rate constants were calculated from the four isotopic enrichment points adjusted for baseline. Carbon dioxide (CO_2) production was calculated using equation A6 of Schoeller et al (1986). Oxygen consumption (O_2) was calculated from CO_2 production using the measured food quotient. The results for FEE, IBEE, DEE (and differences between them) for seven non-smokers (N) and five smokers (S) are shown in the table. Statistical significance of differences between the methods were assessed using paired students t-tests.

Subject no. sex	FEE (MJ/d)	IBEE (MJ/d)	DEE (MJ/d)	percentage differences		
	(F)	(I)	(D)	(I-F)/F	(D-I)/I	(D-F)/F
1(N) F	9.76	11.05	12.31	13.3	11.4	26.2
3(N) M	12.02	12.51	14.63	4.1	17.0	21.7
4(N) M	12.12	11.73	12.65	-3.2	7.9	4.3
8(N) M	8.68	10.26	10.92	18.1	6.4	25.7
9(N) F	7.50	7.73	6.11	3.1	-21.0	-18.5
10(N) F	8.12	8.59	8.61	5.8	0.2	6.0
12(N) F	11.23	9.51	10.48	-15.3	10.2	-6.7
2(S) F	7.89	8.07	10.75	2.3	33.1	36.2
5(S) M	10.92	13.08	11.87	19.8	-9.3	8.7
6(S) M	10.62	12.88	15.26	21.2	18.5	43.7
7(S) M	12.03	13.03	13.55	8.4	2.4	11.0
11(S) F	8.01	10.40	8.58	29.8	-17.5	7.1
group means (\pm SD)						
n=7(N)	9.92 (1.9)	10.20 (1.7)	10.82 (2.8)	3.7 (11)	4.6 (12)	8.4 (17)
n=5(S)	9.90 (1.9)	11.49 (2.2)	11.96 (2.5)	16.3 (11)	5.5 (21)	21.3 (17)

DEE was about 5% (ns) higher than IBEE in both smokers and non-smokers. IBEE and DEE were 16% and 21% higher ($p < 0.03$ and $p < 0.05$ respectively) than FEE in smokers, but not significantly different from FEE in non-smokers.

These results suggest that factorial estimates of EE under-estimate daily EE in smokers compared with nonsmokers.

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WARWICK, P.M., EDMUNDSON M.E and THOMSON E. (1988) *Am. J. Clin Nutr.* 48: 1188.

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Supported by the Australian Tobacco Research Foundation.