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The effect of intermittent *v*. chronic energy restriction on weight loss and markers of chronic disease risk in premenopausal women: a randomised pilot trial

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Excess adiposity increases risk of diseases such as diabetes, CVD, dementia and certain forms of cancer including breast cancer. Weight loss is likely to reduce risk of these diseases but is difficult to achieve and maintain. Animal studies indicate that intermittent energy restriction (IER) may be superior to continuous energy restriction (CER) for improving insulin sensitivity[(1)] and reducing cancer risk[(2)]. It is hypothesised that IER may be superior to CER for reducing weight and improving insulin sensitivity, and may have beneficial effects on other biomarkers of disease risk, e.g. lipids, adipokines and inflammatory and oxidative stress markers and may also be more acceptable to women.

The effectiveness and acceptability of IER (*n* 53) *v*. CER (*n* 54) were tested in overweight or obese premenopausal women (mean age 40.1 (SD 3.9) years, mean adult weight gain 20.7 (SD 11.2) kg). Both diets provided 75% estimated energy requirements; CER subjects had approximately (approx) 6270 kJ (1500 kcal)/d for 7 d/week, IER subjects had approx 2665 kJ (550 kcal)/d for 2 d/week and approx 7524 kJ (1800 kcal) for 5 d/week.

Eighteen women (17%) withdrew from the study before 6 months (IER 11, CER 7; main reasons: stress 4, pregnancy 3, change in employment 3, couldn't stick to diet 3). Change in weight, body composition, anthropometry and biomarkers at 6 months for last observation carried forward are reported.

	IER				CER				
	Baseline		6 Months		Baseline		6 Months		
Variable	Mean	SD	Mean	SD	Mean	SD	Mean	SD	*P*
Weight (kg)	81.5	14.3	75.0	13.8	84.4	17.2	78.8	16.7	0.26
Body fat (kg)	33.6	10.1	28.7	10.0	35.3	12.5	30.9	12.1	0.34
Fat-free mass (kg)	47.6	5.0	46.2	4.6	49.1	5.2	47.9	5.1	0.21
Waist (cm)	102	13.3	95.1	13.0	103	13.8	97.4	13.9	0.13
TAG (mmol/l)	1.2	0.7	1.0	0.4	1.3	0.7	1.0	0.5	0.60
HDL (mmol/l)	1.5	0.3	1.5	0.3	1.6	0.4	1.5	0.4	0.24
LDL (mmol/l)	3.1	0.8	2.9	0.7	3.1	0.8	2.8	0.8	0.93
CRP (mg/l)†	4.5	3.8, 5.4	3.9	3.2, 4.7	3.7	3.2, 4.3	2.9	2.6, 3.4	0.15
HOMA (μU/mmol/l)†	1.5	1.3, 1.8	1.1	0.9, 1.3	1.6	1.3, 1.8	1.3	1.1, 1.6	0.04**
Adiponectin (μg/ml)†	10.6	9.5, 11.8	11.8	10.4, 13.3	10.8	9.7, 12.1	10.9	9.7, 12.3	0.09
Leptin (ng/ml)†	28.5	23.2, 35.0	16.0	12.6, 20.4	28.2	23.5, 33.8	17.1	13.5, 21.7	0.53
IGF-I (total; μg/l)†	201	185, 219	190	172, 209	203	192, 215	204	190, 218	0.17
BDNF (pg/ml)	9539	2079	9264	1769	9898	1847	9528	1594	0.87
Ghrelin (pg/ml)†	136	117, 159	154	125, 190	133	111, 159	149	123, 182	0.92
Ketones (μM)†	40.8	31.5, 52.7	66.4	49.0, 90.0	48.0	37.8, 61.0	51.2	39.4, 66.7	0.12
AOPP fast acting (μM)†	41.5	34.8, 49.5	35.0	30.4, 40.3	43.2	36.7, 51.0	37.0	31.7, 43.2	0.76
AOPP slow acting (μM)†	1.7	1.5, 2.0	1.6	1.3, 1.8	1.4	1.2, 1.7	1.7	1.5, 1.9	0.12

CRP, C-reactive protein; HOMA, homeostasis model assessment of insulin resistance; IGF-I insulin-like growth factor; BDNF, brain-derived neurotrophic factor; AOPP, advanced oxidation protein products. $^{**}P<0.05$. †Median and 95% CI.

IER gives similar results to CER in relation to weight loss and many of the risk variables measured and may be an alternative approach to CER. The superior reductions in insulin resistance with IER may be related to periods of very low energy intake (approx 70% restriction). Future studies will investigate the mechanism of IER and its optimal duration.

1. Anson RM, Guo Z, de Cabo R *et al*. (2003) *Proc Natl Acad Sci U S A* **100**, 6216–6220.
2. Cleary MP, Jacobson MK, Phillips FC *et al*. (2002) *Cancer Epidemiol Biomarkers Prev* **11**, 836–843.