

Symposium on ‘Nutrition: getting the balance right in 2010’

Session 1: Balancing intake and output: food v. exercise Balancing exercise and food intake with lactation to promote post-partum weight loss

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Excess weight gain during pregnancy and post-partum weight retention are risk factors for obesity. While many studies report average weight retained from pregnancy is only 0.5–3.0 kg; between 14 and 20% of women are 5 kg heavier at 6–18 months post-partum than they were before pregnancy. Among normal-weight women, lactation usually promotes weight loss to a moderate extent, but not among those with BMI ≥ 35 kg/m². While exercise and energy restriction may promote weight loss during lactation, their effect on milk volume and composition and, consequently, infant growth must be considered. The effect of exercise on lactation performance has been investigated. Moderate aerobic exercise of 45 min/d, 5 d/week improved cardiovascular fitness, plasma lipids and insulin response; however, it did not promote post-partum weight loss. Breast milk volume and composition were not affected. The effect of exercise with energy restriction in overweight women on the growth of their infants has also been studied. At 1 month post-partum, women restricted their energy intake by 2092 kJ/d and exercised 45 min/d, 4 d/week for 10 weeks. Women in the diet and exercise group lost more weight than the control group (4.8 (SD 1.7) kg v. 0.8 (SD 2.3) kg); however, there were no differences in infant growth. Based on the current evidence, it is recommended that once lactation is established, overweight women may restrict their energy intake by 2092 kJ/d and exercise aerobically 4 d/week to promote a weight loss of 0.5 kg/week.

Lactation: Post-partum weight loss: Energy restriction: Exercise

The prevalence of obesity is increasing among women in their childbearing years. In 2007, the rate of overweight and obesity among UK women aged 25–34 years was 44% and increased to 58% in women aged 35–44 years⁽¹⁾. Excessive weight gain during pregnancy and retention of weight in the post-partum period are risk factors for obesity in later life⁽²⁾. Average post-partum weight retention, defined as the difference in pre-pregnancy weight and weight at 1-year post-partum, ranges from 0.5 to 3.0 kg; however, 14–20% of women retain more than 4.5 kg one year after childbirth⁽³⁾. This paper will review research findings on the role of lactation, exercise and diet on reducing post-partum weight retention.

Rooney and Schauburger⁽²⁾ examined weight change among 540 women during pregnancy, 6 months post-partum and then 5–10 years later. Average weight retention

at 6 months post-partum was 1.7 kg. Average weight gain was 6.3 kg at long-term follow-up measurements. The significant predictors of weight gain in the later years were excessive weight gain during pregnancy, post-partum weight retention, breastfeeding and exercise. Women with no post-partum weight retention gained 2.4 kg a decade later, compared to 8.3 kg among those who retained weight gain during pregnancy. Women who breastfed for at least 12 weeks had the smallest weight gain in follow-up; women who did not breastfeed had the largest gain. Women who reported exercising in the post-partum period gained less weight one decade later compared to those who reported not exercising.

The energy cost of lactation is approximately 2092 kJ/d⁽⁴⁾. This additional energy requirement may be met by increasing energy intake, decreasing energy

expenditure and/or mobilising maternal fat stores. This results in weight change during lactation being highly variable among women. For example, some women may gain weight during lactation due to increasing energy intake beyond the requirement for breast milk production, whereas others may lose weight because they did not increase their energy intake and adipose stores were utilised to support lactation. The UK recommendations for the additional energy intake during lactation range from 1883 to 2385 kJ/d, depending on the month post-partum⁽⁵⁾. The USA and Canada suggest an additional 1381 kJ/d during the first 6 months of lactation⁽⁴⁾. This recommendation is based on the energy content of milk (estimated to be 2092 kJ/d) minus the mobilisation of fat stores (estimated to be 711 kJ/d). It was assumed that women do not change their energy expenditure from their pre-pregnancy activities through the post-partum period. However, this assumption may not be accurate among all lactating women. Dewey *et al.*⁽⁶⁾ measured energy expenditure (not including the energy costs of breast milk) in fully breastfeeding women and reported an increase of almost 837 kJ/d from 6 weeks to 12 weeks post-partum. These results suggest that women may be very sedentary and spend a larger amount of time sitting and nursing their infants in the early weeks after childbirth. As infants become older and feed less frequently, mothers may return to the same activity level they had before pregnancy. This change in energy expenditure may explain why many women do not lose weight in the early months of breastfeeding.

Research on weight loss with lactation supports this theory. When reviewing the literature on breastfeeding and post-partum weight retention, the majority of studies only show a significant relationship when women breastfeed fully for at least 6 months post-partum. Baker *et al.*⁽⁷⁾ reviewed weight changes in 36 030 Danish women and estimated that women lost 0.06–0.09 kg for every week of full breastfeeding. However, breastfeeding was negatively associated with post-partum weight retention only in women with BMI < 35 kg/m². Krause *et al.*⁽⁸⁾ reported similar results among 14 330 low-income, racially diverse women in the USA. There was no association between breastfeeding and post-partum weight retention at 3 months post-partum. However, at 6 months post-partum, weight retention was 1.38 kg lower in women who fully breastfed and 0.84 kg lower in women who combined breastfeeding with formula, compared to women who only formula fed their infants. Both studies controlled for other factors affecting post-partum weight loss such as maternal age, pre-pregnant BMI, gestational weight gain, ethnicity and marital status and still found these significant relationships with breastfeeding and post-partum weight loss.

While these recent, large epidemiological studies report that breastfeeding is positively related to post-partum weight loss, the effect is small. In addition to breastfeeding, diet and physical activity need to be considered in recommendations for post-partum weight loss. However, the effects of exercise and reduced energy intake on breast milk volume and composition, and consequently infant growth and health, must be considered.

The first intervention trial on the effects of aerobic exercise in fully breastfeeding women was reported by

Table 1. Body composition, cardiovascular fitness level and energy intake before and after the intervention in the diet-and-exercise and control (Data from reference 10) groups (Mean values and standard deviations)

	Baseline		End of study		Change	
	Mean	SD	Mean	SD	Mean	SD
Weight (kg)						
Diet-and-exercise	75.9	9.4	71.0*	8.8	-4.8*	1.7
Control	76.8	7.8	76.0	8.8	-0.8	2.3
BMI (kg/m ²)						
Diet-and-exercise	27.6	2.4	25.9†	2.3	-1.8*	0.6
Control	28.0	2.1	27.5	2.5	-0.3	0.9
Body fat (% weight)						
Diet-and-exercise	33.8	3.3	30.4†	2.9	-3.3*	1.8
Control	33.2	4.0	33.0	4.3	-0.2	1.8
Fat mass (kg)						
Diet-and-exercise	25.8	5.1	21.8†	4.2	-4.0*	2.0
Control	25.6	4.9	25.3	5.5	-0.3	1.8
Fat-free mass (kg)						
Diet-and-exercise	50.1	5.2	49.3	5.3	-0.8	1.1
Control	51.2	4.7	50.6	5.0	-0.6	1.6
Cardiovascular fitness (V _{O2} ml/kg/min)						
Diet-and-exercise	35.1	3.5	39.7†	5.4	4.9*	4.7
Control	35.2	5.4	35.8	6.6	0.6	3.8
Energy intake (kJ/d)						
Diet-and-exercise	9259	2402	6983†	1226	-2276	1971
Control	9950	1824	8962	2259	-987	2125

*Significantly different from the control group, $P < 0.01$.

†Significantly different from the control group, $P < 0.05$.

Dewey *et al.*⁽⁶⁾. At 6 weeks post-partum, sedentary women were randomised to either an exercise group, which consisted of brisk walking at 60–70% of maximum heart rate for 45 min/d, 5 d/week, for 12 weeks; or a control group who remained sedentary. The duration of the initial session was 20 min; with subsequent sessions increasing by 5 min every 3 d until 45 min/d was achieved. Research assistants travelled to participants' homes and monitored the exercise sessions. There were no dietary restrictions and women in both groups were advised not to change their eating habits.

There was no significant difference in weight loss between groups after the 12-week study. Both groups lost an average of 1.6 kg, which was predominantly fat mass. Participants were expending an average of 1761 kJ in their 45 min exercise session. However, they compensated for this by increasing their energy intake. The reported daily energy intake of the exercise group was 1377 kJ higher than the control group at the end of the intervention. This resulted in a similar energy deficit and weight loss among exercising and sedentary women. Yet, the exercise group significantly improved their insulin response to a test meal, cardiovascular fitness, and HDL cholesterol levels more than the control group⁽⁹⁾. Breast milk volume and composition was not different between exercising and sedentary groups.

Lovelady *et al.*⁽¹⁰⁾ investigated the addition of energy restriction to the same exercise protocol to examine the effects of weight loss in overweight, lactating women on the growth of their infants. Sedentary (defined as engaging in exercise no more than once per week during the

previous 3 months), fully breastfeeding women were randomised at 4 weeks post-partum to either restrict energy intake by 2092 kJ/d and exercise aerobically for 45 min/d (diet-and-exercise group), 4 d/week; or to maintain their usual dietary intake and not exercise (control group). Energy requirement for lactation was estimated for each participant, using the Harris–Benedict equation; which considers age, weight and height and activity level. A moderate level activity factor was used in the equation. Additional energy (2636 kJ) was added to cover the needs for lactation. The prescription for energy intake for weight loss was determined by subtracting 2092 kJ from this estimated energy requirement. No participant was prescribed a diet of less than 7531 kJ/d. After the 10-week intervention, the diet-and-exercise group lost an average of 4.8 (SD 1.7) kg (primarily fat mass) compared to 0.8 (SD 2.3) kg in the control group (Table 1). Ten of the twenty-one women in the diet-and-exercise group (48%) compared to four of the nineteen women in the control group (21%) were within 1 kg of their pre-pregnancy weight at the end of the study. Cardiovascular fitness improved an average of 13% in the diet-and-exercise group compared to an increase of 2% in the control group. Women in the diet-and-exercise group significantly decreased their intake of fats, sweetened drinks, sweets and desserts, and snack foods such as chips compared to the control group⁽¹¹⁾. Average energy intake and percentage of energy from fat at the end of the study was significantly lower in the diet-and exercise group (diet-and-exercise = 6983 (SD 1226) kJ, 23.5 (SD 5.2)% v. control = 8962 (SD 2259) kJ, 31.4 (SD 3.6)%). Gain in infant weight and length were similar in both groups.

Lovelady *et al.*⁽¹²⁾ recently reported results on the effects of aerobic and resistance training on body composition in fully breastfeeding women. At 4 weeks post-partum, women were randomly assigned to either an intervention consisting of aerobic exercise 3 d/week and resistance exercise 3 d/week or to a sedentary group. The resistance programme was conducted in the home of the participants, supervised by a research assistant. Participants used handheld adjustable weights and stability balls to perform squats, bench presses, standing military presses, stiff-leg dead lifts, high pulls, pushups, bent-over dumbbell rows, wall sits, abdominal planks and abdominal crunches. The aerobic portion consisted of brisk walking, following the protocol described in the previous studies. Participants in both groups were asked not to change their dietary intake during the study.

Both groups lost approximately 3.6 kg during the 16-week study. The control group decreased their energy intake by an average of 1766 kJ compared to the exercise group's decrease of 782 kJ. The combination of increased energy expenditure and decreased energy intake in the exercise group was probably similar to the energy deficit of only reduced energy intake in the control women, resulting in the same weight loss between groups. The exercise group increased their strength and endurance by 34–221% for all exercises compared to changes of –5.7% to 12% in the control group. Cardiovascular fitness increased by 11.4% in the exercise group v. 6.9% in the control group; however, this difference was not significant. Infant weight gain and growth were similar in both groups.

The results of these intervention studies suggest that exercise alone, without energy restriction does not promote weight loss in lactating women. Exercise sessions were monitored by research assistants and compliance was high in all three studies. While average weight loss was not different from sedentary participants; aerobic exercise improved plasma lipids, insulin response to a test meal and cardiovascular fitness. Resistance exercise increased muscular strength and endurance.

Recent epidemiological studies suggest that full breastfeeding for at least 6 months promotes post-partum weight loss in women with BMI < 35 kg/m². Yet, some women may need to add exercise and dietary energy restriction to enhance weight loss in the post-partum period and reduce the risk of obesity in later life. Once lactation is established, overweight and obese women may restrict their energy intake by 2092 kJ/d to promote a weight loss of 0.5 kg/week. Research suggests that this rate of weight loss will not affect infant growth. In conclusion, exercise alone, without energy restriction does not promote post-partum weight loss. Instead, full breastfeeding for at least 6 months post-partum, and energy restriction with aerobic exercise, may be a successful strategy to promote post-partum weight loss.

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