Comparison of Dietary Intake of Overweight Postpartum Mothers Practicing Breastfeeding or Formula Feeding

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Abstract:

Background: Weight gain in the postpartum period is a risk factor for long-term obesity. Investigations of dietary intake among lactating and non-lactating, overweight women may identify nutritional concerns specific to this population.

Objective: To compare nutrient, meal and snack intakes, food group servings and prevalence of dieting among fully breastfeeding (BF) mixed breast and formula feeding (MF), and formula feeding (FF), overweight and obese women. The second aim was to compare nutrient intakes and food group servings to the Dietary Reference Intake (DRI) and MyPyramid recommendations, respectively.

Design: Data were collected from September 2004 through April 2006 in Durham, NC. Infant feeding practices and dietary information were collected on 450 women between six and nine weeks postpartum. Two 24-hour dietary recalls were completed by phone, using Nutrition Data Systems for Research. Analysis of covariance was used to compare infant feeding groups in dietary quality (nutrient intake per 1000 kcal) and food group servings, controlling for pre-pregnancy body mass index, race, age, education, income, and marital status. Chi-squared (X^2) analysis was performed to determine differences in meal and snack intake and dieting among infant feeding groups.

Results: BF women consumed more energy (2107 ± 50 kcal) than MF (1866 ± 56 kcal) or FF (1657 ± 50 kcal), $p<0.001$. Adjusted nutrient intake did not differ between groups. All groups were at risk for inadequate intakes of vitamins A, E, C, and folate and did not meet recommended servings of all food groups. BF women consumed lunch and snacks more frequently, were less likely to diet and reported higher intakes of grains and desserts than MF and FF women.

Conclusions: To help increase intakes of nutrients lacking in the diet and prevent postpartum weight gain, overweight women should be encouraged to increase fruits, vegetables, low-fat dairy, whole grains, legumes, and healthy types of fat, while decreasing refined grains, regular soda, sweetened beverages, and desserts.

Article:

INTRODUCTION

The National Center for Health Statistics reports 25.5% of United States women ages 20 to 39 were overweight and 34% were obese in 2007–2008 (1). The postpartum period is a critical time for weight-management interventions because weight retention and weight gain in this period are significant predictors of long-term obesity (2,3). However, there are few published studies on the dietary intake of overweight and obese women who have recently delivered babies.

George et al. (4) evaluated diets of 142 low-income, non-lactating postpartum women. During the late postpartum period total energy, saturated fat and sugar were above the national average, while women failed to meet dietary recommendations of grains, vegetables, fruits and dairy. In contrast, Fowles and Walker (5) reported predominantly white postpartum women consumed adequate dairy servings, but vegetable intake was not sufficient. Two studies have reported a higher consumption of fruits and vegetables and a lower fat intake among lactating women as compared to formula feeding women (6,7). The few studies of nutrient intake during lactation report calcium, zinc, folate, and vitamins E, D, and B-6 intakes are often lower than recommended (8,9).

Investigations of dietary intake in the postpartum period among lactating and non-lactating, overweight and obese women may help to identify nutritional concerns specific to this population. Therefore, the overall purpose of this study was to assess nutrient intake, food group servings, meals and snack intake, and the prevalence of dieting among a large, diverse sample of overweight and obese postpartum women with two-month old infants. Since nutrient needs of postpartum women are determined by lactation status, the sample was divided into three groups: 1) those fully breastfeeding (BF), 2) those combining breast milk and formula (mixed feeding, MF) and 3) those formula feeding (FF) their infants. The primary aim was to compare nutrient intake and food group servings among these three groups. The second aim was to evaluate dietary quality by comparing nutrient intakes and food group servings to the Dietary Reference Intake (DRI) and MyPyramid recommendations, respectively. The results from these analyses may be used in dietary interventions designed to promote postpartum weight loss among overweight and obese women.

MATERIALS AND METHODS

Study Design

This paper reports the baseline dietary intake of overweight and obese postpartum women enrolled in a randomized controlled behavioral intervention study, Active Mothers Postpartum (AMP). Data were collected from September 2004 through April 2006 in Durham, North Carolina. The overall aim of AMP was to evaluate the effect of a nine month intervention to increase physical activity and decrease energy intake on weight loss among postpartum women who were overweight or obese prior to pregnancy (10). It was based on the theory that the postpartum period may be a teachable moment to promote weight loss and healthy weight maintenance by making weight-related lifestyle changes. Participants were recruited from obstetric clinics and through posters in public areas. Eligibility criteria were pre-pregnancy body mass index ≥ 25 kg/m^2, age ≥ 18 years, and English speaking. A research assistant met participants at their six week postpartum visit at their obstetrician's office and obtained written, informed consent. After baseline measurements were completed, participants were randomized

to intervention or control groups. Only the baseline measurements are reported in this paper. The overall study is described in detail elsewhere (10). The protocol was approved by the institutional review boards of the University of North Carolina at Greensboro and Duke University Medical Center.

Measurements

A trained research assistant measured height using a stadiometer (Road Rod Portable Stadiometer, Seca, Columbia, MD) and weight using a digital scale (Tanita BWB-800, Tanita, Arlington Heights, IL) during the participant's six week postpartum obstetrics' visit. All participants were measured in light clothing and without shoes. Within three weeks, participants were contacted by phone and completed a survey of demographic information, including age, race, education, income, marital status and parity, pre-pregnancy height and weight, and gestational weight gain. They were also asked how their infant was currently being fed: BF, MF, or FF. During this interview women were also asked how many times per week they ate from a fast food restaurant like Burger King, Chick-Fil-A, or Pizza Hut.

A trained research assistant collected two 24-hour dietary recalls from each participant via phone within a two week period, using the Nutrition Data System for Research (NDSR, version 5.0, 2004 and 2005, Minneapolis, MN) (11,12). NDSR is a multiple pass approach that details daily food consumption in a phone interview format. The multiple pass approach has proven to be an effective strategy to accurately record 24-hour recalls among women (13,14). Prior to the initial recall, participants were mailed a two-dimensional food portion guide to use in estimating the portion sizes of what they consumed. The participant was asked during each recall if the intake represented usual daily consumption; if it did not, the participant was called back at a different time. Additionally, during each recall participants were asked about supplement use (vitamin, mineral, diet aids, or herbal supplements) and whether they considered themselves to be dieting at the time of the recall ("Are you currently following a formal diet plan?"). Because of participant availability and time constraints during this early postpartum period, it was not always feasible to obtain one intake on a weekend day.

Consistent with Barr et al. (15), the average of the two days of dietary intake was used for analysis, unless the participant only completed one intake, then this intake was used. Dietary data were analyzed for nutrient composition, food group servings, and meal and snack intakes using NDSR. To compare dietary quality between groups, nutrient intakes were adjusted per 1,000 calories to control for variation in total energy intake among women.

Average nutrient intakes were compared to the Dietary Reference Intakes (DRI) [Adequate Intakes (AI), Acceptable Macronutrient Distribution Ranges (AMDR) or Estimated Average Requirement (EAR)] for lactating (BF and MF groups) and adult women (FF group). Estimated energy requirements were calculated for each participant, using the DRI equation for women and adding 330 kcal for full breastfeeding and 165 kcal for mixed feeding. For nutrients with a defined AI and EAR, the percent of participants in each group with intakes less than the AI or EAR were calculated. The requirement for protein was calculated for each participant, using 1.05 g/kg/day for the BF and MF groups and 0.66 g/kg/d for formula feeding women (16). Risk of dietary nutrient inadequacy was defined as $\geq$ 50% of the group not meeting the EAR for the specified nutrient (15).

Food group serving sizes were defined in the NDS per the *Dietary Guidelines for Americans 2005* (17). Food groups were consolidated into the following: fruits, vegetables, grains, dairy, meat, fish, poultry, eggs, nuts, seeds, meat alternatives, fats, beverages, miscellaneous foods (e.g. pickled foods, gravy, sauce, condiments), and desserts. Food group servings were compared to the MyPyramid for Moms (18) recommendations for BF, MF and FF women. MyPyramid for Moms is a web based program which individualizes recommendations for women based on the *Dietary Guidelines for Americans 2005*. Since these recommendations are individualized based on physical activity level, height, weight, age, infant's age and the method by which the infant is feeding, hypothetical reference women were created using the average characteristics of the 450 AMP participants. This resulted in reference women who were sedentary; 165 cm tall, weighed 89 kg, were 31 years old, had a two month old baby, and were either fully breastfeeding, mixed feeding or formula feeding.

Statistical Analysis

Data was analyzed using JMP software (JMP 7.0, 2007, SAS Institute, Cary, NC). Means and standard errors (SE) were calculated for all continuous variables. Categorical variables were summarized as frequencies and percentages. Analysis of variance (*ANOVA)* and Chi-squared (X^2) analysis were performed to determine differences in characteristics between groups. Tukey's post hoc analysis was used to determine where significant differences existed between group characteristics. The significance level was set at $P \leq 0.05$.

Analysis of covariance (*ANCOVA*) was used to determine whether there were differences between BF, MF and FF groups in dietary quality (using energy adjusted nutrient intake) and servings of food groups. Covariates were pre-pregnancy BMI, race, age, education, income, and marital status. Previous studies have reported relationships between these variables and dietary intake among postpartum women (4,7,19). The Bonferroni correction was used to avoid Type 1 error that is often associated with multiple comparisons. This resulted in the revised significance level at $P \leq 0.001$ for analysis of all nutrients and food group servings. Chi-squared (X^2) analysis was performed to determine differences in meal and snack intake among infant feeding groups. The significance level was set at $P \leq 0.05$.

RESULTS

Food intakes were collected from all of the 450 women enrolled in the study. Twenty-two participants completed only one, not two days of dietary recalls, due to time constraints or unavailability. However, their data was included in the analysis because it represented typical dietary intake and did not significantly alter findings. Participant demographic and anthropometric characteristics are shown in Table 1. Of the total 450 women, 36% were fully breastfeeding, 28% were mixed feeding, and 36% were formula feeding. FF women were significantly younger and more likely to have a higher pre-pregnancy and baseline BMI, be black, single, less educated, earning less than BF and MF women. Gestational weight gain and percentages of primiparous and multiparous women were similar among groups.

A higher percentage of the FF group reported dieting compared to the BF and MF groups (Table 1). They were also less likely to report consuming a vitamin, mineral, and or fish oil supplement than BF and MF women. MF women were more apt than BF and FF women to report taking an

herbal supplement, primarily to increase milk production (example Fenugreek). The use of weight loss dietary aides was negligible among all groups (n= 4).

Table 1: Demographic and anthropometric characteristics of fully breastfeeding, mixed feeding, and formula feeding groups in the Active Mothers Postpartum Study

	Fully breastfeeding (n=60)	Mixed feeding (n=128)	Formula feeding (n=162)
Characteristics	*mean±standard error*		
Age (y)	32.1±0.4^{x}	31.3±1.0^{x}	29.4±0.4^{y}
Gestational weight gain (kg)	15.0±2.0	15.2±2.0	15.0±2.0
Prepregnancy BMI[a]	29.0±1.0^{y}	31.2±1.0^{x}	33.0±1.0^{x}
BMI at baseline	31.0±1.0^{x}	33.1±1.0^{y}	35.0±1.0^{z}
Height (m) at baseline	1.6±0^{x}	1.6±0^{x}	1.6±0^{x}
Weight (kg) at baseline	83.0±1.0^{y}	89.7±1.7^{x}	93.7±1.7^{x}
	n (%)		
Race*			
White	109 (68)	56 (44)	63 (39)
Black	51 (31)	72 (56)	99 (61)
Other	10 (1)	10 (1)	3 (1)
Education *			
≤ High school graduate	15 (9)	20 (16)	58 (36)
Some college	31 (19)	33 (26)	46 (28)
≥ College graduate	114 (71)	75 (56)	58 (36)
Income *			
Up to $30,000	22 (14)	40 (32)	60 (38)
$30,001 - $60,000	43 (28)	38 (30)	50 (32)
$60,001 or more	90 (58)	47 (38)	48 (30)
Marital status*			
Single, never been married	5 (3)	24 (19)	47 (29)
Living with a partner	10 (6)	16 (13)	23 (14)
Married	141 (88)	81 (63)	87 (54)
Separated/divorced/widowed	4 (3)	7 (5)	5 (3)
Parity			
Primiparous	61 (38)	56 (44)	68 (42)
Multiparous	99 (62)	72 (56)	94 (58)
Dietary status*			
Dieting	8 (5)	16 (13)	31 (21)
Vitamin/mineral/fatty acid supplementation*			
Yes	128 (80)	92 (72)	69 (43)
Herbal supplementation			
Yes	7 (4)	7 (6)	1 (1)

[a]BMI=body mass index; calculated as kg/m^2

^{xyz}Groups with different letters are significantly different, analysis of variance; $P \leq 0.05$.

*Significantly different between groups x^2, $P \leq 0.05$.

Dietary Quality and Nutrient Intakes

As shown in Table 2, BF women reported consuming significantly more energy than MF and FF women. The energy intake of women reporting dieting versus those not dieting was significantly lower in the MF and FF groups. The percentage of energy from protein (16–17%), carbohydrate (49–51%), and fat (33–35%) were within the AMDR (16). Based on the EAR, all groups were at risk for inadequate dietary intakes of vitamins A, E, C, and folate and more than half reported consuming less than 50% of the AI for calcium. In the MF and FF groups, more than half of the participants consumed less than 50% of the AI for vitamin D. Additionally, MF women were also at risk for inadequate zinc intake. After adjusting for energy and covariates, reported nutrient intakes were not significantly different between groups.

Table 2: Comparison of dietary intake of mothers fully breastfeeding, mixed feeding, or formula feeding: Active Mothers Postpartum Study[a]

	DRI[b] lactating	DRI nonlactating	Fully breastfeeding (n=160)	Mixed feeding (n=128)	Formula feeding (n=162)
Estimated energy requirement (kcal)			2,407±11	2,478±18	2,523±18
Energy intake (kcal)					
Total sample			2,107±50[x]	1,866±56[y]	1,657±50[z]
Dieters			2,095±363	1,468±105	1,342±92
Nondieters			2,110±54	1,915±57	1,717±59
Carbohydrates (g)	210[c], 160[d]	130[c], 100[d]	264±7	236±8	202±7
% <EAR[e]			11%	18%	10%
Protein[f] (g)	71[c], 60[d]	46[c], 38[d]	85±2	77±2	68±2
% <EAR			16%	24%	11%
Total fat (g)			82±3	70±3	66±3
Saturated fat (g)			29±1	24±1	23±1
Monounsaturated fat (g)			30±1	26±1	25±1
Polyunsaturated fat (g)			16±1	14±1	13±1
PUFA[g] 18:2 (linoleic acid) (g)	13[h]	12[h]	14±1	12±1	11±1
PUFA 18:3 (linoleic acid) (g)	1.3[h]	1.1[h]	1.6±0.1	1.3±0.1	1.2±0.1
PUFA 22:6 (docosahexaenoic acid) (g)			0.1±0.0	0.1±0.0	0.1±0.0
Trans-fatty acids (g)			5±0	4±0	5±0
Cholesterol (mg)			317±15	281±16	270±14
Alcohol (g)			1±0	1±0	1±0
Total fiber (g)	29[h]	25[h]	18±1	14±1	12±1
Total vitamin A activity (µg retinol equivalents)	1,300[c], 900[d]	770[c], 500[d]	910±51	794±57	566±50
% <EAR			57%	75%	54%
Vitamin D (calciferol) (µg)	5[h]	5[h]	6±0	5±0	4±0
% AI[i]			49%	61%	72%
Vitamin E (total α-tocopherol) (mg)	19[c], 16[d]	15[c], 12[d]	8±0	7±0	6±0
% <EAR			91%	97%	95%
Vitamin C (ascorbic acid) (mg)	120[c], 100[d]	75[c], 60[d]	88±5	92±6	68±5
% <EAR			65%	70%	53%
Vitamin B-6 (mg)	2.0[c], 1.7[d]	1.3[c], 1.1[d]	2.0±0	1.7±0	1.5±0
% <EAR			37%	48%	25%
Total folate (µg)	500[c], 450[d]	400[c], 320[d]	498±17	423±19	340±17
% <EAR			55%	63%	52%
Calcium (mg)	1,000[h]	1,000[h]	1,029±35	814±39	670±35
% <AI			54%	75%	81%
Iron (mg)	9[c], 6.5[d]	18[c], 8.1[d]	17.4±1	15.1±1	12.5±1
% <EAR			3%	5%	23%
Zing (mg)	12[c], 10.4[d]	8[c], 6.8[d]	12.1±1	11.6±1	8.1±1
% <EAR			44%	54%	31%
Sodium (mg)	1,500[h]	1,500[h]	3,522±100	3,155±112	2,921±100

[a]Nutrients shown are not adjusted for energy intake. Values are mean_standard error unless otherwise indicated.
[b]DRI_Dietary Reference Intake.
[c]Recommended Dietary Allowance.
[d]Estimate Average Requirements (EAR).
[e]% _EAR is the percentage of group whose intake was below the Estimated Average Requirements.
[f]The requirement for protein was calculated for each participant, using 1.05 g/kg/day for the fully-breastfeeding and mixed-feeding groups and 0.66 g/kg/day for formula-feeding women.
[g]PUFA_polyunsaturated fatty acid.
[h]Adequate Intake (AI).
[i]% _AI is the percentage of group whose intake was below the AI recommendation.
[xyz]Groups with different letters are significantly different; *P*_0.001.
NOTE: Information from this table is available online at www.adajournal.org as part of a PowerPoint presentation.

Servings of Food Groups

Average food group servings are presented in Table 3. As compared to the reference participant (i.e., the "average" AMP woman), BF, MF, and FF participants did not meet MyPyramid (18) recommendations for servings of fruits, vegetables, grains, whole grains, dairy, meats and beans and fat. BF and MF women consumed significantly more discretionary calories from dessert than FF women. Consumption of alcohol was minimal; while the average intake of sweetened

beverages and soft drinks was approximately one and a half servings per day. BF women reported consuming more servings of most food groups when compared to MF and FF women. After adjusting for covariates, servings of grains, refined grains, and desserts were significantly different among BF, MF and FF women. FF women consumed significantly less servings of refined grains and desserts than BF and MF women. FF women consumed significantly less servings of total grains than BF women, while MF women consumed similar amounts to BF and FF women. There was not a significant difference in fast food intake between groups (Table 3).

Table 3: Average number of food group servings of fully breastfeeding, mixed feeding, and formula feeding groups in the Active Mothers Postpartum Study compared to MyPyramid recommendations[a]

	Fully Breastfeeding (n=160)		Mixed Feeding (n=128)		Formula Feeding (n=162)	
Food groups	**Recommended[b]**	**Consumed**	**Recommended[b]**	**Consumed**	**Recommended[b]**	**Consumed**
Fruits	4	1.3±0.1	4	1.4±0.1	4	0.8±0.1
Vegetables	6.5	3.2±0.1	6	2.6±0.2	6	2.3±0.1
Vegetables		2.4±0.1		1.9±0.1		1.6±0.1
Fried potatoes		0.2±0.0		0.2±0.0		0.2±0.0
Legumes		0.1±0.0		0.1±0.0		0.1±0.0
Starchy vegetables		0.4±0.0		0.4±0.1		0.3±0.1
Grains	9	6.7±0.2^{x}	7	6.0±0.2^{xy}	7	5.0±0.2^{y}
Whole wheat and some whole-wheat grains	4.5	2.0±0.1	3.5	1.4±0.1	3.5	1.1±0.1
Refined grains		4.3±0.2^{x}		4.3±0.2^{x}		3.5±0.2^{y}
Snack chips		0.4±0.0		0.2±0.1		0.3±0.0
Protein	6.5	5.6±0.2	6	5.6±0.3	6	5.2±0.2
Beef and pork		1.5±0.1		1.8±0.1		1.3±0.1
Poultry		1.7±0.1		1.8±0.2		2.1±0.1
Fish		0.7±0.1		0.7±0.1		0.5±0.1
Cold cuts and sausage		0.7±0.2		0.7±0.1		0.7±0.1
Eggs		0.5±0.1		0.4±0.1		0.5±0.1
Nuts and seeds		0.4±0.1		0.2±0.1		0.1±0.1
Meat alternatives		0.1±0.0		0.1±0.0		0.0±0.0
Dairy	3	2.3±0.1	3	1.9±0.2	3	1.7±0.2
Whole and reduced-fat (2%) milk		0.4±0.1		0.1±0.1		0.4±0.1
Reduced-fat (1%) and nonfat milk		0.6±0.1		0.4±0.1		0.2±0.1
Cheese		0.7±0.0		0.6±0.1		0.6±0.0
Yogurt		0.1±0.0		0.1±0.0		0.05±0.0
Cream		0.5±0.1		0.4±0.1		0.5±0.1
Fats	8	3.5±0.2	6	3.0±0.2	6	2.5±0.4
Beverages		2.5±0.2		2.2±0.2		2.7±0.2
Regular soft drinks		0.4±0.1		0.5±0.1		0.8±0.1
Diet soft drinks, un-sweetened tea, and coffee		1.3±0.1		0.9±0.1		1.0±0.1
Sweetened fruit drinks and tea		0.7±0.1		0.8±0.1		0.7±0.1
Alcoholic beverages		0.1±0.0		0.1±0.0		0.1±0.0
Miscellaneous						
Sauces and condiments		0.9±0.1		0.7±0.1		0.9±0.1
Pickled foods		0.1±0.0		0.1±0.0		0.1±0.0
Desserts		1.2±0.1^{x}		1.0±0.1^{x}		0.7±1.0^{y}
Number of fast-food meals/week		←		*n (%)*		→
None		20 (13)		22 (17)		13 (8)
<1		45 (28)		20 (16)		24 (15)
1		45 (28)		26 (20)		40 (25)
2		30 (19)		36 (28)		44 (27)
3 to 5		18 (11)		21 (16)		34 (21)
>5		2 (1)		3 (2)		7 (4)

[a]Values are n or mean_standard error, except where otherwise indicated.---[b]Recommended food group servings based on MyPyramid guidelines for reference participants who represents the average Active Mothers Postpartum participant (sedentary, 165 cm, 89 kg, 31 years old, with a 2-month-old baby, who was either fully breastfeeding, mixed feeding, or formula feeding) (18).---xyzGroups with different letters are significantly different, *P*_0.001 (when adjusted for group differences in participant characteristics, ie, prepregnancy body mass index, race, age, education, income, marital status). NOTE: Information from this table is available online at www.adajournal.org as part of a PowerPoint presentation.

Meal and Snack Intake

There were no differences in frequency of breakfast consumption among BF, MF, or FF groups. Less than six percent of the participants reported no breakfast on either day of the recalls. Most consumed breakfast both days (BF = 90%, MF = 86%, and FF = 79%, p=0.06). Women who were fully breastfeeding were more likely to consume lunch (BF = 90%, MF = 82% and FF = 67%, $p < 0.01$) and snacks (BF = 77%, MF = 55%, and FF = 47%, $p < 0.01$) on both days. The majority of women (n=399) reported consuming dinner on both days, with no differences between groups.

DISCUSSION

This is the first study to compare nutrient intake, diet quality, and meal patterns of a relatively large and diverse cohort of overweight and obese breastfeeding, mixed feeding, and formula feeding women. Several areas of concern regarding dietary intake during the postpartum period have been identified with this analysis. Among this sample, FF women were heavier, yet reported consuming less energy, fewer servings of grains, refined grains and desserts, and were at greatest risk for not meeting the EAR for specific nutrients. The lower reported food intake may be due to the higher prevalence of dieting among FF women. However, the risk for nutrient inadequacies is a concern as only 43% of FF women supplemented with multivitamins or minerals compared to 80% BF and 72% MF women. Furthermore, the FF women were also significantly younger, more likely to have a higher pre-pregnancy BMI and to be black, single, less educated and earn less money than BF and MF women. Therefore, dietitians should focus on this population during pre-conception and pregnancy, recommending breastfeeding and emphasizing their risk for nutrient inadequacies.

These overweight and obese women had volunteered to participate in a research study to promote postpartum weight loss, yet only 12% reported “dieting” when recalling their dietary intake. The prevalence was lowest (5%) among the fully breastfeeding women. This group may believe that breastfeeding promotes weight loss and that restricting energy intake is not necessary. However, a recent study by Baker et al. (20) found that breastfeeding was negatively associated with weight retention at six and 18 months postpartum, in women with BMI’s < 35 kg/m^2, but not among those with BMI’s ≥ 35 kg/m^2. Their results suggest that heavier breastfeeding women may need to restrict energy intake in order to promote postpartum weight loss. Lovelady et al. (21) reported that energy restriction of 500 kcal/day from four to 14 weeks postpartum in fully breastfeeding, overweight women resulted in a weight loss of 4.8 ± 1.7 kg versus 0.8 ± 2.3 kg in women not restricting their energy intake. There was also no negative effect of weight loss on infant growth.

The National Academy of Sciences (NAS) recommends that lactating women consume 330 additional kcal from energy in the first six months postpartum (16). BF women in this study consumed on average 2107 kcal, 450 more than FF women and 241 more than MF. The additional energy consumed by BF women came from a greater consumption of grains and desserts and higher frequency of snacking and lunch. Reported energy intake among BF women was similar to other studies assessing energy intake among lactating women (7–9).

During lactation, nutrient requirements for vitamins A, B-6, and C, and zinc are substantially increased (16,22,23). Mackey et al. (8) found that lactating women had diets that were lacking in

calcium, zinc, folate, and vitamins E, D, and B-6. Berg et al. (24) also showed decreased intakes of folate and zinc during the postpartum period. In this study, overweight and obese BF, MF, and FF women were at risk for inadequate intakes of vitamins A, E, C, and folate. In all groups more than half of the participants consumed less than 50% of the AI for calcium. In addition, in the MF and FF groups more than half of the participants consumed less than 50% of the AI for vitamin D. This was likely a result of not consuming the recommended number of servings of dairy products.

The impact of dieting on nutrient intakes remains unclear. During a maternal energy restriction study, Dusdieker et al. reported that when fully breastfeeding women restricted daily food intake by approximately 500 kcal/day, they lost weight, but still met 90% or more of the RDA or AI for calcium, vitamin A, riboflavin, niacin, thiamin, vitamin C, and iron (25). However, in a study by Lovelady et al., the AI for vitamin D and calcium were not met by lactating women who decreased energy intake by 500 kcal/day (9). In this study, dieting may have impacted the nutrient intake (via low food intake) of FF participants (21% reported dieting), but was probably not affecting the nutrient intake of BF women (only 5% reported dieting).

The recommended number of servings in MyPyramid (18) were not met by any infant feeding group when compared to the study reference participants. These results are similar to those from other studies, which reported that dietary quality remained inadequate during the postpartum period, often not meeting the recommended intakes for bread (7), milk (7), vegetable (7,19) and fruit (19). George et al. (7) reported that lactating women were more likely to have lower fat intake than formula feeding women; however, there were no differences in fat intake among groups in this study. While there was not a significant difference in fast food intake between groups, there was a trend towards a higher frequency of fast food meals among FF women, compared to BF and MF groups. This may be due to the FF group being significantly younger than the other two groups. Further, all women consumed substantial amounts of refined grains, regular soda, sweetened beverages, and desserts, all typically associated with excessive energy intake and minimal nutrient density. Such negative choices may be associated with the rising rates of obesity (26,27).

Consuming lunch and snacks, but not breakfast and dinner, differed significantly among groups. BF women were more likely to report eating lunch and snacks. However, a higher frequency of food intake did not result in an increase in the nutrients lacking in the diets of the breastfeeding women (vitamins A, C, E, and folate).

The limitations of this study include the lack of menstrual cycle documentation, the reliability and validity of the diet methodology (two 24-hr recalls), and the fact that the nutrient data base was not up-to-date on vitamin D sources in food (and therefore underestimated vitamin D intake). In addition, underreporting of food intake among overweight participants has been shown to be higher than in normal weight subjects (28–30). Therefore, it is possible the women may have underreported dietary intake during the diet interview. In this study, even women not reporting dieting had average energy intakes less than the EER (BF = 374, MF = 489 and FF = 577 kcal). Therefore, this limitation should be considered when interpreting these results.

CONCLUSION

In this group of overweight and obese postpartum women, FF women consumed less energy and servings of grains and desserts were more likely to diet, and less likely to consume a multivitamin supplement compared to BF or MF women. Lactating women increased their energy intake by consuming more refined grains and desserts and had a higher frequency of snacking. When adjusted for total energy, nutrient intake was not different among BF, MF, and FF groups. Overweight and obese BF, MF, and FF women were at risk for inadequate dietary intakes of vitamins A, E, C, and folate. All groups did not consume the recommended number of dairy servings, resulting in a high percent consuming less than 50% of the AI for calcium and vitamin D.

These results suggest that overweight and postpartum women need guidance to improve their dietary intake to promote postpartum weight loss. Energy restriction of 500 kcal less than the EER, to promote a moderate weight loss of one pound a week, should be recommended by the dietitian, even for breastfeeding women after lactation has been established. To help increase intakes of nutrients that are lacking in the diets, dietitians should encourage women to increase fruits, vegetables, low-fat dairy, whole grains, legumes, and healthy types of fat, while decreasing refined grains, regular soda, sweetened beverages, and desserts. Multivitamin and mineral supplements may also be recommended. Dietitians should also suggest low kcal snacks for breastfeeding women. These recommendations by dietitians may reduce further weight gain and risk for long term obesity. These recommendations should also be used in dietary interventions designed to promote postpartum weight loss among overweight and obese women.

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