Research and Professional Briefs

Greater Nutrition Knowledge Is Associated with Lower 1-Year Postpartum Weight Retention in Low-Income Women

HENRY NUSS, PhD; JEANNE FREELAND-GRAVES, PhD, RD; KRISTINE CLARKE, PhD, MPH, RD; DEBORAH KLOHE-LEHMAN, PhD, RD; TRACEY J. MILANI, PhD

ABSTRACT

The purpose of this study was to assess nutrition knowledge during early and late postpartum in a sample of low-income and minority women, and to determine if that knowledge had any relationship to weight retention at 1-year postpartum. A questionnaire was developed and validated in a sample of 151 low-income new mothers. This instrument was then administered to a separate sample of mothers (n=140) of similar demographics to assess nutrition knowledge at 0 to 1 days and 12 months postpartum. In addition, a survey of nutrition information sources was administered at both time points. Nutrition knowledge was compared with 12-month postpartum weight retention and demographic variables. Women who retained less than 5% of weight gained during pregnancy had greater knowledge of nutrition at 0 months (53% vs 49%, $P<0.05$) and 12 months (55% vs 51%, $P<0.05$) than those who retained 5% or more of weight gained during pregnancy. Whites had higher nutrition knowledge scores than non-Hispanic blacks and Hispanics. Women who lactated 6 months or more had more knowledge than those who lactated less than 6 months. Higher knowledge test scores were observed among women who used the Internet and books/magazines as their source for information. These results indicate that assessment of nutrition knowledge in early postpartum can identify women at risk for significant weight retention.
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H. Nuss is a research nutritionist, US Department of Agriculture, Agricultural Research Services, Baton Rouge, LA; at the time of the study, he was a doctoral candidate at the University of Texas at Austin. J. Freeland-Graves is the Bess Heflin Centennial Professor and Head, Nutritional Sciences, The University of Texas at Austin. K. Clarke is an assistant professor, the University of Utah, Salt Lake City. D. Klohe-Lehman is a child nutrition outreach program specialist, Texas Department of Agriculture, Austin. T. J. Milani is a senior account executive, Euro RSCG Life PR and Noonan Russo, San Diego, CA; at the time of the study, she was a graduate student, Division of Nutritional Sciences, The University of Texas at Austin.

Address correspondence to: Henry Nuss, PhD, USDA-ARS, 900 S Shackleford Rd, Little Rock, AR 72211-3845. E-mail: hnuss@spa.ars.usda.gov

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In the United States, the majority of adults are overweight (66%) (body mass index [BMI; calculated as kg/m^2]=25 to 30) or obese (32%) (BMI ≥30) (1,2). In general, the incidence of obesity is greater in women than men (34% vs 30%), and increased risk is associated with low socioeconomic, minority status (2-4), and being of childbearing age (2,3,5). In some women, weight retained from pregnancy seems to contribute to overweight/obesity later in life (6-9) and this may have adverse long-term health effects (10-12).

Why some women retain weight gained from pregnancy is not fully understood. Factors such as excessive gestational weight gain (13-15), depression (16,17), high energy intake (17), lactation status (6,18,19), maternal insulin concentrations during pregnancy (20) and age (21) influence postpartum weight retention. However, the impact of nutrition knowledge on weight status is unclear.

A positive relationship with nutrition knowledge and weight loss was observed by Klohe-Lehman and colleagues (22) in non-postpartum overweight/obese low-income women with young children. Participants who lost more weight had greater nutrition knowledge at the beginning and end of an 8-week weight-loss intervention. Domel and colleagues reported similar findings in non-Hispanic blacks (23) and Hispanics (24) after an 11-week nutrition education and behavioral modification pilot program.

The association of nutrition knowledge with weight reduction also has been seen in 60 obese adults who participated in a 12-week program emphasizing diet, nutrition counseling, and physical activity (25). In addition, Menza and colleagues (26) observed a relationship between increased nutrition knowledge and more weight loss in 20 overweight and obese patients on a 1-year weight control program of nutrition and exercise.

In two separate behavioral intervention studies, weight loss at 12 months (27) to 18 months (28) was increased in well-educated white women as compared with control subjects. Although nutrition knowledge was not measured in either study, this suggests that nutrition education delivered during postpartum may promote weight loss.

The purpose of this study was to assess nutrition knowledge in low-socioeconomic status women in early and late postpartum and to discern its influence on weight retention at 1 year postpartum.

METHODS

A test of general nutrition knowledge was developed and validated in 151 low-income women at day 1 after childbirth. Procedures for test development were adapted from Parmenter and Wardle (29). The 50 multiple-choice and true/false questions were derived from the media and literature topics related to nutrient content of foods, diet/disease relationships, and dietary recommendations. Test items were reviewed by a panel of nutrition and health professionals to establish face validity. The revised instrument was pilot-tested in low-income new mothers. Item exclusion criteria were: 20% or less correct response rate, 80% or more correct response rate, item-to-total correlation of 0.2 or less, and a Cronbach $\alpha > .7$ (29). Twenty-five test items were discarded based on this criteria and the reformatted test was reviewed for content validity.

Discriminate validity was established by administering the test to nutrition graduate students and registered dietitians (n=17) and comparing scores to 125 undergraduates. Validity was confirmed, as the graduate students/dietitians scored higher (94.9% vs 56.1%, $P<0.001$). Test-retest reliability was done in 100 undergraduate students measured repeatedly at 2 weeks apart; Pearson's correlation coefficient (r)=0.79. An exploratory factor analysis to determine any latent constructs found no discernable loadings, supporting the concept that the instrument measured general nutrition knowledge. Internal consistency reliability (Cronbach α=.89) was more than the established acceptable level of 0.7 (30,31). Tests were scored by calculating the percentage of correct responses.

The knowledge test and a brief survey that identified sources of nutrition information used by participants were administered to 140 women days 0 to 1 after childbirth and at 12 months postpartum. In addition, a demographics questionnaire (age, parity, education level, ethnicity, marital status) was completed at days 0 to 1 postpartum. Subjects visited a clinic at 1.5, 6, and 12 months postpartum and were measured for body weight to the nearest 0.1 kilogram (kg) at 1.5, 6, and 12 months using a calibrated digital scale (Model No. HS100, Fairbanks Scales, Kansas City, MO). Prepregnancy weight was self-reported, and gestational weight gain was obtained from hospital records. Height was recorded at 1.5 months using a stadiometer (Perspective Enterprises, Portage, MI). Lactation status was assessed at 1.5, 6, and 12 months postpartum. Postpartum weight retention was calculated as $(w_x - w_0/w_0) \times 100$, where w_x represents postpartum weight (at 1.5, 3, 6, and 12 months) and w_0 represents prepregnancy weight.

Descriptive statistics were computed for demographic and weight variables, nutrition knowledge total scores, and individual test items. The χ^2 statistic detected differences in distributions of demographic, lactation, and weight groups. The paired-samples t test determined differences between baseline and 12-month nutrition knowledge. The McNemar's test identified changes in dichotomously coded variables. A multivariate analysis of variance examined changes in knowledge over time, followed by univariate analyses of covariance on 12-month nutrition knowledge. Covariates, such as age, parity, lactation status, and education were adjusted for preexisting differences among variables.

All forms were checked for completeness, accuracy, and correct entry. Each participant was informed about the nature of the study and signed a consent form approved by the Institutional Review Board at The University of Texas at Austin.

RESULTS

The age of test subjects was 22.5±0.33 (mean±standard error of the mean) years with a range of 18 to 35. Subjects were 40.7% Hispanic, 30.7% non-Hispanic black, and 28.6% white; women had a parity of 1 to 2. Less than half were high school graduates; more than 60% were not married or living with a partner, and 62.1% lactated for 0 to 1.5 months. All subjects were eligible for the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC).

Prepregnancy BMI was 25.8±0.49 (range 16.4 to 45.2). At childbirth, mean BMI was 30.4±0.5 (20.7 to 48.5), which decreased at 1.5 months postpartum to 28.2±0.5 (18.9 to 46.9, $P<0.001$). The 12-month BMI was 28.3±0.6 (17.7 to 47.6), which represents a mean weight increase of +6.5±0.7 kg (range −14.0 to 42.4 kg) and an increase of +9.8% from prepregnancy weight ($P<0.001$). Nearly two thirds (n=88) of subjects weighed 5% or more than their prepregnancy weight (mean weight gain=11.0±0.7 kg, range 2.9 to 25.8 kg). Subjects of this subgroup tended to be younger (43.2% between 18 to 20 years) and less educated (40.9% with no/partial high school) ($P<0.05$) than those who were less than 5% over their prepregnancy weight at 1 year (mean weight loss of −1.5±0.6 kg, range −14.0 to 3.5 kg). Less than one fifth lactated for 6 months or more after childbirth.

On day 1 following childbirth, the mean knowledge score for the test sample was 53.1%±0.9% (24.0% to 76.0%) and did not change significantly at 12 months postpartum (54.8%±1.0%, 28.0% to 84.0%). Selected individual items that changed significantly are listed in the Table. Subjects who lactated 0 to 1.5 months postpartum had lower 12-month knowledge scores than the other lactation groups ($P<0.05$), controlling for other covariates (Figure 1). Whites had higher knowledge scores than both non-Hispanic blacks and Hispanics ($P<0.001$) (Figure 1). However, using baseline scores as a covariate negated the difference at 12 months. Younger mothers had lower scores (52.6%±1.2%) than the older mothers (57.3%±1.5%) at 12 months only ($P<0.05$). Education had a positive influence on knowledge, as the most educated group had higher scores than the others ($P<0.01$).

The most common source of nutrition information reported on day 1 after childbirth was a physician (55.7%), followed by books/magazines (55.0%), family (45.7%), friends (36.4%), and television (22.9%). Sources used least were food labels (15.0%) and the Internet (14.3%). At 1 year, use of all the various nutrition information sources had decreased, with books/magazines becoming the most prevalent information source (40.0%, $P<0.001$), followed by fam-

Table. Sample nutrition knowledge test items and responses of low-income and minority women at 0 and 12 months postpartum (n=140)

Test item[a]	% Correct Responses	
	Postpartum month 0	Postpartum month 12
Which food contains the greatest amount of fiber per cup?		
a. Brownies	4.3	0.0
b. Corn flakes	40.0	40.7
c. Iceberg lettuce	5.0	2.9
d. *Kidney beans*	37.1	44.3**
e. Pasta	13.6	12.1
Which of the following has the least amount of high-quality protein?		
a. *Corn*	37.9	54.3***
b. Egg	7.9	7.9
c. Milk	9.3	7.9
d. Tofu	34.3	22.1
e. Wheat	10.7	7.9
Which of the following foods has the highest amount of fat?		
a. Bagel	7.1	6.4
b. *Blueberry muffin*	30.7	39.3**
c. Saltines	10.0	8.6
d. Pretzels	12.9	7.1
e. All the same	39.3	38.6
Not enough _____ in the diet has been linked to birth defects involving the brain and spine (spina bifida).		
a. Calcium	14.3	10.7
b. *Folic acid*	54.3	60.7**
c. Iron	23.6	22.9
d. Vitamin A	4.3	2.9
e. Vitamin C	3.6	2.9
Phytochemicals can be found in which of the following?		
a. Dairy products	7.1	3.8
b. Eggs	5.7	5.8
c. *Fruits and vegetables*	27.1	42.3*
d. Meats	9.3	11.5
e. All of the above	50.7	36.5
A pregnant woman requires more calories than a woman who is breastfeeding.		
False	87.9	72.9*
True	12.1	27.1
Watermelon is an excellent source of vitamin C.		
False	20.7	32.1*
True	79.3	67.9

[a]Correct responses are italicized.
*Percent correct responses different from 0 months postpartum $P<0.05$.
**Percent correct responses different from 0 months postpartum $P<0.01$.
***Percent correct responses different from 0 months postpartum $P<0.001$.

ily (32.9%, $P<0.001$) and friends (29.3%, $P<0.001$). At all time points, the more educated women (40%) used the Internet as a source of nutrition information (vs 35% no/partial high school, 25% high school graduates, $P<0.05$). Women who lactated 0 to 1.5 months postpartum (44%) were less likely to obtain nutrition information from a physician compared with those who lactated for 1.5 to 6 months or 6 months or more (78%, and 73%, respectively, $P<0.01$). This was also true for the use of books and magazines (45%, 70%, and 73%, respectively, $P<0.01$). Women who lactated 6 months or more (31%) used food labels more often than those who lactated for 0 to 1.5 months (10%) or 1.5 to 6 months (15%, $P<0.05$).

Women who had less than 5% weight retention (compared with prepregnancy weight) during the first postpartum year had greater nutrition knowledge at 0 and 12 months (Figure 1). Controlling for demographic and lactation variables had no effect. However, entering baseline scores as a covariate did reduce statistical significance at 12 months (56.4 ± 1.2 vs 54.0 ± 1.0, $P<0.10$). At 0 months, those with smaller weight retentions were more cognizant of the relative amounts of fiber in foods (44% vs 25%, $P<0.05$), and energy values of "low-fat" vs "regular" food items (85% vs 65%, $P<0.05$). At 1 year, these women also knew more about the relative protein (69% vs 46%, $P<0.01$) and energy contents of foods (73.1% vs 48.9%,

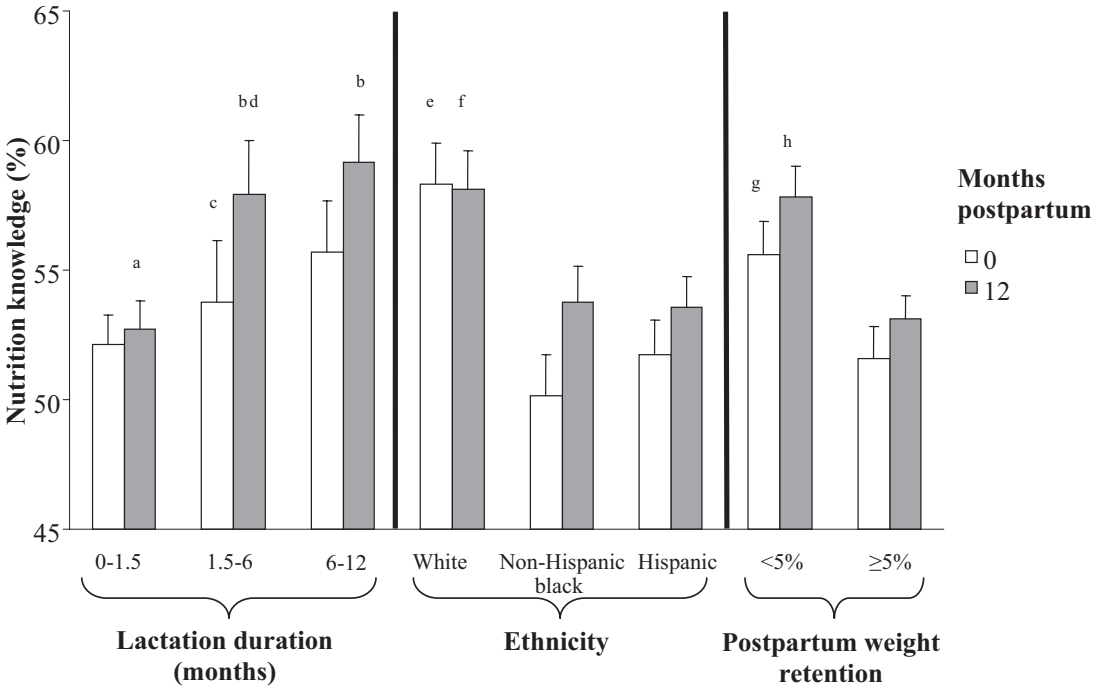

Figure 1. Nutrition knowledge scores of low-income and minority women at 0 and 12 months postpartum as compared by lactation duration (up through first postpartum year), ethnicity, and amount of weight retained from prepregnancy to 1 year postpartum. [ab, cd]Within lactation groups, bars with different superscripts are significantly different ($P<0.05$). [ef]Within ethnic groups, significantly different than non-Hispanic black and Hispanic at 0[(e)] and 12[(f)] months postpartum ($P<0.001$). [gh]Within weight retention groups, significantly different than ≥5% weight retention group at 0[(g)] and 12[(h)] months postpartum ($P<0.05$).

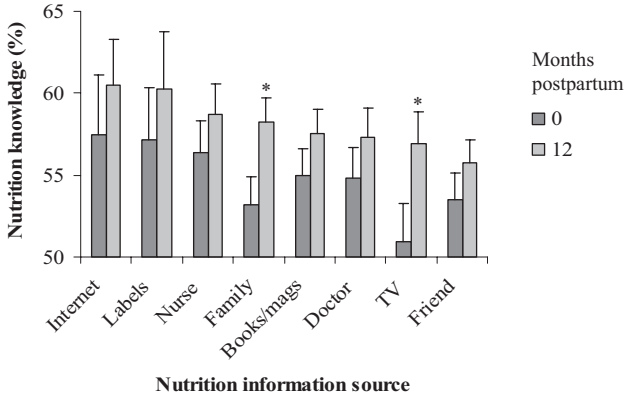

Figure 2. Nutrition knowledge scores of low-income and minority women as compared by use of primary nutrition information sources at 0 and 12 months postpartum. Adjusted for demographic variables. *Within nutrition information source categories, significantly different than 0 months postpartum ($P<0.05$).

$P<0.05$), and the relationship of a folic acid deficiency to spina bifida (73% vs 53%, $P<0.05$).

Nutrition knowledge did not vary according to sources of nutrition information initially (Figure 2). At 1 year, only those who relied on family and TV as information sources had significant increased knowledge (53.5±0.8 vs 58.2±1.2, and 54.2±0.8 vs 58.1±1.7, respectively, $P<0.05$). Greater knowledge was seen in those who relied on books and magazines (57.6±1.4 vs 53.4±1.0), nutrition labels (59.9±2.3 vs 54.2±0.9), the Internet (60.5±2.8 vs 54.3±0.9), family (58.2±1.5 vs 53.5±1.0), and a nurse (58.7±1.8 vs 53.9±1.0), compared with those who did not use these sources ($P<0.05$).

DISCUSSION

These results indicate that women who had a better understanding of nutrition retained less weight at 1 year postpartum than those who had lower scores on a nutrition knowledge test. To our knowledge, we are unaware of any other noninterventional studies, such as this one, that compared postpartum weight status to measured nutrition knowledge. However, one intervention study of postpartum weight retention supports our finding (28). Leermaker and colleagues found that predominantly white (97%) subjects who received instructions to reduce fat/energy intake and increase physical activity lost more postpartum weight than control subjects at 6 to 18 months after childbirth (7.8 kg vs 4.9 kg, $P<0.05$, respectively). Nutrition knowledge, however, was not measured.

In a recent study of low-income, non-postpartum women, Klohe-Lehman and colleagues (22) found an inverse relationship between measured nutrition knowledge and weight status after an 8-week intervention. Subjects who lost weight (≥2.27 kg) had higher pre- and post-test knowledge scores than those who did not lose or gained weight (60% vs 54%, and 72% vs 66%, respec-

tively, $P<0.05$). Similar weight-loss interventions also have observed that nutrition knowledge is associated positively with enhanced weight reduction in US non-Hispanic black (32) and Swedish women (33). Collectively, these findings suggest that nutrition knowledge does influence a healthful weight status.

In our study, whites had higher nutrition knowledge than non-Hispanic blacks and Hispanics. Others also have reported that whites have greater nutrition knowledge than minorities (34-36), and that this may be explained by educational disparities (37). However, controlling for education had no effect in our study. One explanation might be that the whites more often sought nutrition information from the Internet, books, and magazines in contrast to non-Hispanic blacks and Hispanics, who sought advice from friends and family members. It is conceivable that accuracy of advice from friends and family may be less factual than the Internet or printed materials. However, this is mentioned with strong caution as not all information obtained from the Internet is factual or accurate.

In the present study, 15% used nutrition labels, which is less than reported in other low-income and minority populations (38-40). However, those who read nutrition labels had greater weight loss (7.1 kg vs 3.0 kg, $P<0.05$) and nutrition knowledge than those who did not. Krummel and colleagues (41) also found that label use was more common in WIC-enrolled postpartum white (91%) women actively trying to lose weight. Similarly, Papakonstantinou and colleagues found that label users had better knowledge of fats, vitamins, and energy balance than nonusers among white, well-educated, non-postpartum women (35). In our subjects, regardless of ethnicity, the same was true.

Breastfeeding for an extended amount of time was associated with higher nutrition knowledge scores, even after controlling for education. Havas and colleagues (42) also noticed that breastfeeding WIC-enrolled participants from a predominantly non-Hispanic black study sample were more likely to know the recommended servings of fruits and vegetables than non-breastfeeding women. The same was true for our subjects regardless of ethnicity.

Only a few women in this study accurately answered questions regarding the fat and energy content of foods. Although not significant, these subjects retained 3 kg less than those who did not correctly answer the questions at 1-year postpartum. This suggests that specific knowledge about fat and energy may be important. Others have also observed a positive association between fat and energy knowledge and healthful weight status (22,43).

CONCLUSIONS

Assessment of nutrition knowledge in early postpartum can help nutrition and health professionals identify women who may be at risk for retaining excessive weight. Minority women should receive special attention because non-Hispanic black and Hispanic women had lower knowledge and greater postpartum weight retention. Breastfeeding was positively associated with nutrition knowledge and lower weight retention, and should be encouraged by health care professionals.

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