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# **In-home Prenatal Nutrition Intervention Increased Dietary Iron Intakes and Reduced Low Birthweight in Low-Income African-American Women**

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Low birthweight (LBW), defined as an infant weighing less than 2,500 grams (1), is a major determinant of infant mortality and contributes to infant and childhood morbidity and increased healthcare costs (2–4). LBW occurs due to preterm delivery (length of gestation

less than 37 weeks), growth retardation, or both (2). In the United States, higher rates of LBW occur in urban areas with high concentrations of low-income ethnic minorities (5). Results of the 1997 Pediatric Nutrition Surveillance indicate that the rate of LBW in the United

States was 13% for African-American infants, and 8% for whites (6). Healthy People 2010 (7) outlines an overarching goal to eliminate health disparities among different segments of the population, including differences that occur by race or ethnicity.

Reviews of the medical nutrition therapy literature indicate a continuing need to document the specific contribution of the registered dietitian to health outcomes attained (8). In the specific area of prenatal nutrition interventions, Boyd and Windsor (9) concluded there is a need for high-quality prenatal nutrition education programs, including descriptions of program process and content. Published reports of nutrition interventions suggest that programs are more likely to be successful if they are adapted to the particular minority target culture (10) and if they are individualized to the specific client's needs (11). A continuing need exists for well-documented and effective prenatal nutrition interventions designed to reduce the incidence of LBW among minority populations. The objective of this project was to evaluate an in-home prenatal nutrition intervention designed to prevent LBW among low-income African-American women.

### Subjects and Methods

Volunteers were 27 pregnant African-American women residing in a county with representative rates of LBW similar to those of the United States. The women were recruited through the local county health department WIC Program and they were all at 24 weeks gestation or less. They had no pre-existing health conditions and none of them were following prescribed diets. Women were randomly assigned to either an intervention or a control group.

The intervention protocol (Table 1) was adapted from Widga and LBW is (12) and required a minimum of 6 individualized in-home nutrition assessment and counseling visits. Visits were scheduled weekly for the first 4 weeks, and then monthly for 2 more visits. Some clients delivered their babies within the month following the sixth visit. For those who

had not yet delivered, monthly visits continued until parturition. Women in the control group were visited twice. The protocols for the 2 visits were the same as the first and fifth visits of the intervention group, except that teaching and counseling were omitted. Height and weight were measured at the initial visit using a portable stadiometer (Perspective Enterprises, Inc., Kalamazoo,

Mich) and a portable scale (Health-0-Meter, Inc., Bridgeview, Ill). Self-reported pre-pregnancy weight was also recorded. Follow-up weights were measured at each visit. Birthweights were obtained from the mothers and were checked with hospital records. The study was approved by the Institutional Review Board for the Protection of Human Subjects in Research Studies.

**Table 1.** Prenatal nutrition intervention curriculum guide

Visit no.	Topic	Subject matter
1	Introduction to intervention and initial data collection	24-hour dietary recall Height and weight measurements Prenatal questionnaire Pre-pregnancy questionnaire Two 24-hour dietary recalls obtained by telephone following this visit
2	Basic nutrition weight gain during pregnancy	Food frequency Food guide pyramid <sup>a</sup> Recommended weight gain based on individual's BMI <sup>b</sup> Weight gain graph <sup>a</sup> <i>Hey Baby</i> (Ref. 20) and <i>Baby Under Construction</i> <sup>a</sup> <i>Nine-Month Journey</i> <sup>c</sup> (Ref. 22)
3	Special nutrient needs during pregnancy	Discussed calcium, iron, folate, fiber, and protein sources Discussion of dietary intake compared to Food Guide Pyramid <sup>a</sup> <i>Inside My Mom</i> <sup>c</sup> (Ref. 21) Discussed goal setting strategies Individual goal setting <sup>a</sup>
4	How to make it all work	<i>Healthy Foods, Healthy Baby</i> (teenagers only) <sup>c</sup> (Ref. 23) Menu planning Shopping Tips <sup>a</sup> Discussed goal achievement
5	Is it working	Reassessment of dietary intake Strategies for managing weight gain
6	Healthy habits as a new mom	Discussed pre and post pregnancy computer diet analysis <sup>a</sup> Importance of continued good nutrition Special needs for breastfeeding
7-10	Review (optional)	Reinforcement of previous topics

a. Copies of teaching materials given to client.

b. BMI=body mass index, defined as weight (kg)/ht (m<sup>2</sup>).

c. Audiovisual shown at that visit.

**Table 2.** Mean daily nutrient intake of low-income African-American women before and after prenatal nutrition intervention

Nutrient	RDA <sup>a</sup>	Intervention group (n= 10)				Control group (n=10)			
		Before		After <sup>b</sup>		Before		After <sup>b</sup>	
		Amount <sup>c</sup>	%RDA	Amount <sup>c</sup>	%RDA	Amount <sup>c</sup>	%RDA	Amount <sup>c</sup>	%RDA
Energy (kcal)	2,480 <sup>d</sup>	2,219±742	89.5	2,082±612	84.0	2,458 ± 72	99.1	2,227±871	89.8
Vitamin B-6 (mg)	1.9	1.6±0.4	84.2	2.3±0.6	121.1	1.7±0.5	89.5	1.7±0.9	89.5
Calcium (mg)	1,000	984±385	98.4	816±200	81.6	965±554	96.5	739±424	73.9
Folate (µg)	600	271 ±69	45.1	337±120	56.2	284±138	47.3	245±155	40.1
Iron (mg)	30	12.6±3.7	42.3	19.4±8.2**	64.5	15.9±6.7	53.1	14.4±6.1	48.3
Zinc (mg)	15	10.2±4.1	67.7	10.7±3.2	71.1	11.0±4.7	73.4	10.5±4.7	70.2

a. RDA=based on 1989 Recommended Dietary Allowance or DRI=based on 2000 Dietary Reference Intakes.

b. After the fifth in-home visit.

c. Intakes presented as means±standard deviation.

d. Based on Harris-Benedict formula plus pregnancy and activity factors.

\*\*  $p < .01$

We suggest that programs designed to address the needs of African-American women during pregnancy need to promote culturally acceptable foods to increase dietary intakes of iron, folate, and zinc.

Dietary data collected from both groups included three 24-hour recalls before and after the intervention. Food models, measuring cups and spoons, and food pictures were used to help clients determine portion sizes. Food Processor Plus computer software (ESHA research, 1995, Salem, Ore) was used to analyze all dietary intakes. Mean daily energy and nutrient intakes were determined before and after the intervention for both groups. Intakes were analyzed and expressed as percent Recommended Dietary Allowance or Dietary Reference Intake (13,14) with 75% RDA/DRI or more considered within normal limits. SAS statistical software (SAS Institute Inc, Gary, NC, 1994) was used for statistical analysis of all data. Chi-square was used to compare demographic characteristics of the two groups and t tests were used to compare energy and nutrient intakes. Paired t tests were used to identify significant changes in intakes from pre- to post-intervention.

### Results and Discussion

Of the 27 women recruited, 20 completed the study (10 in the intervention group and 10 in the control group). The 7 women who dropped out (5 from the intervention group and 2 from the control group) indicated that time constraints prevented them from scheduling appointments with the nutritionist. Demographic data for those who completed the study indicated that 7 women in each group (70%) were 21 years of age or younger, 8 in the intervention group (80%) and 10 in the control group (100%) were single, 6 in the intervention group (60%) and 9 in the control group (90%) had a high school education or less, and 8 in the intervention group (80%) and 7 in the control group (70%) had an annual household incomes of less than \$15,000. Nine women in the intervention group (90%) and 10 in the control group (100%) lived with family or friends, and 6 women in each group (60%) were unemployed. There were no significant differences between the intervention and control groups in demographic characteristics. Demographic characteristics of women in this study are similar to those reported in larger studies (15).

Mean (±standard deviation) pre-pregnancy body mass index was within the normal range for both groups (intervention, 24.7±3.4; control, 23.2±4.1). Mean weight gain (intervention, 11.9±6.3 kg; control,

15.2±5.1 kg) for each group was within the recommended range of 11.4 to 15.9 kg. (16).

Infant birthweight (intervention, 3.54±0.4 kg; control, 3.06±0.5 kg) was significantly higher in the intervention group than in the control group ( $P<.05$ ). One birth in the control group was premature and all others births in both groups were full-term births. For the intervention group, iron consumption increased ( $P<.01$ ) and vitamin B-6 and folate tended to be higher ( $P<.10$ ) after the intervention (Table 2). Zinc intakes remained at approximately 70% of the RDA before and after the intervention in both groups. Mean energy intakes before and after the intervention were more than 80% of the RDA for both groups.

Johnson et al (15) stated that only in regions where there is some form of dietary deprivation could maternal nutrition intervention significantly affect infant birthweight. Results of this study indicate that infants of women in the intervention group (whose nutrient consumption came closer to meeting RDAs/ DRIs than women in the control group) had a higher mean birthweight. Dietary improvements may have increased the chances of bearing an infant of appropriate weight. Anthropometric measurements and number of in-home visits by a nutritionist have been reported as predictive of infant birthweight (12,15). Ed-

wards et al (17) attributed the reduction in number of LBW infants delivered by participants in their study to the psychological and social support provided by project staff during the participants' pregnancies. In this small study it is not possible to evaluate the independent influence of dietary improvements or nutrition intervention. Furthermore, potential confounding factors were not assessed. Further study is needed to identify the relationship of factors such as diet quality and social support to infant birthweight in at-risk women.

In low-income white women, pre-intervention folate and zinc intakes were above 75% of the RDA (12). Only iron intake was low (58% RDA), but increased to 70% of the RDA after the intervention. In contrast, in African-American women, folate and zinc intakes were less than 70% RDA/DRI before the intervention and remained less than 75% RDA/DRI after the intervention.

One limitation of this study is that we did not obtain data on the interval since the last pregnancy. Rawlings et al (18) reported that short interpregnancy intervals were more frequent among African-American than among white women. Among the African-American women, an interpregnancy interval of less than 9 months was associated with a significantly greater prevalence of preterm delivery and LBW ( $P = .02$ ). However, among white women, only intervals of less than 3 months between pregnancies were associated with a greater prevalence of prematurity and LBW ( $P < .001$ ). A second limitation is the small number of women in this study. A follow-up study including a larger, more diverse population (i.e., both urban and rural women) is warranted.

### Applications

Based on the results of this study, we suggest that programs designed to address the needs of African-American women during pregnancy need to promote culturally

acceptable foods to increase dietary intakes of iron, folate, and zinc. Due to the high percentage of single mothers and young mothers, a support system including family, friends, and health professionals needs to be incorporated as part of nutrition intervention to facilitate dietary behavior changes and to provide psychosocial support. Practitioners may want to consider how their interventions fit in a broader conceptual framework such as an ecological model that considers the environment around us (19).

Practitioners are encouraged to follow a defined prenatal nutrition intervention protocol and to document their associated outcomes. If we are to make progress in documenting the role of nutrition intervention in reducing the incidence of LBW among minority populations we must use defined protocols. This will make it possible to compare outcomes of prenatal nutrition interventions for low-income women across different health-care settings. In addition to dietary and birthweight outcomes, nutritionists who have access to biochemical data might include biochemical markers of iron status. Documented outcomes are needed for evaluation of the cost-effectiveness of nutrition care.

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