Relationships of Substance Abuse to the Nutritional Status of Pregnant African-American Women

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The effect of illicit drug use, which was determined from fasting blood samples, on maternal nutritional status was examined in a study of African-American pregnant women. Participants were classified as drug users, trace drug users, and nondrug users. Quantitative self-reported dietary records and maternal anthropometric measurements were collected. Consumption of protein, vitamin A, ascorbic acid, selected B-complex vitamins, and phosphorus equaled or exceeded 100 percent of the 1989 Recommended Dietary Allowances (RDA) for all groups. Vitamin B_6, calcium, folate, iron, magnesium, and zinc were consumed in amounts below 100 percent of the 1989 RDA. Food energy, nutrient intakes, sociodemographic characteristics, maternal anthropometric measurements, and delivery weight were similar among the three groups. The unexpected results of this study may be due to the method used to classify the participants. Thus, more extensive research is needed.

Illicit and nonillicit drug abuse is a major interest of clinicians, public health officials, and social authorities (e.g., child welfare). Moreover, one of the major concerns is drug abuse during the periconceptional period and throughout pregnancy because of its potential adverse effects on the health of the mother, embryo, fetus, and neonate *(14,36,37)*.

Age, race, and socioeconomic status are among the most frequently cited factors associated with low birth weight and preterm delivery. Specifically, being young, being African American, and having a low socioeconomic status are most often associated with adverse pregnancy outcomes *(1,11,18,19,32, 39)*. A higher maternal educational level is associated with better health knowledge and behavior *(35)*.

One to 58 percent of pregnant women use drugs *(47)*. Such wide variations in reported use could be attributed to the voluntary nature and lack of adequate drug-screening techniques, disparate patterns of drug use among different U.S. regions and populations, differences in drug-screening methods, or differences in levels of prenatal care among drug-using populations *(27)*. Lack of agreement exists in the scientific literature regarding the most prevalent illicit drugs used during pregnancy. However, research shows that about 11 percent of pregnant women in the United States use at least one of the following drugs: cocaine, marijuana, heroin, methadone, phencyclidine (PCP), and amphetamines *(40)*. Each year in this country, more than 200,000 infants are exposed *in utero* to one or more illicit drugs *(9,45)*.

Women who abuse illicit drugs and alcohol during pregnancy are an elusive population. These women often remain unidentified to practitioners and researchers and therefore have not been studied to a great extent *(22)*. Despite the even distribution of illicit substance use across demographic categories, poor women and women of color are far more likely than are other women to be reported to health and child welfare authorities for use of substances during pregnancy, even when their base rates for use of illicit drugs are considered *(22)*.

Little information is available on the nutritional consequences of substance abuse during pregnancy, and the available studies of women who have used nonillicit as well as illicit drugs during pregnancy have provided conflicting results regarding the nutritional effect on users*(26,30)*. Some evidence shows that cocaine acts as an appetite suppressant*(52)*. Another shows increased caloric intake and low levels of plasma zinc among marijuana users *(29)*. Researchers estimate that nearly 50 percent of opiate-dependent women suffered from anemia, heart disease, diabetes, pneumonia, or hepatitis during pregnancy and childbirth*(52)*.

Another study shows that women who consumed alcohol during pregnancy drank more frequently before pregnancy than did women who drank alcohol prenatally but not during pregnancy *(33)*. Jacobson and others *(25)* also found that many mothers reported higher levels of alcohol consumption before pregnancy than during pregnancy. One plausible interpretation is that the mothers underreported their actual levels of drinking when they were interviewed at prenatal clinics because of the stigma associated with drinking during pregnancy. This may be especially likely when women are interviewed in a prenatal clinic where the health and welfare of the infant is focal. Alternatively, self-reported alcohol consumption by pregnant women may be influenced by their current level of drinking, which is typically higher.

Excessive alcohol consumption impairs the metabolism of most nutrients. Ethanol intake also leads to negative nitrogen balance and an increased protein turnover *(8,52)*. However, evidence concerning the adverse effects of alcohol on specific nutritional indices comes mainly from studies of nonpregnant, hospitalized alcoholics; few data are available on the effect of alcohol on maternal nutrition *(52)*. Information is particularly sparse on the diets of pregnant women of African descent and almost nonexistent for pregnant women who are substance abusers. In one study, maternal and umbilical cord blood zinc levels were lower in pregnant women who consumed alcohol than in those who did not *(16)*. Another study suggested that alcohol may impair placental transport of amino acids *(15)*.

Another behavior—cigarette smoking—may affect maternal nutrition by decreasing the availability of calories and certain nutrients such as vitamin B_{12}, amino acids, folate, and zinc *(52)*. Efforts to improve maternal and fetal nutrition during pregnancy have focused on achieving appropriate energy intakes and ensuring that the intake of specific nutrients is adequate to meet maternal and fetal requirements *(52)*.

Despite researchers' efforts in recent years to document the consequence of maternal substance abuse on pregnancy outcomes, information on specific maternal consequences of substance abuse during pregnancy is sparse. Thus this study focused on the relationships of nonillicit (alcohol and tobacco) and illicit (cocaine, marijuana, heroin, PCP, and opiates) substance abuse to the nutritional status of pregnant African-American women residing in an urban environment.

Methods

Research Design and Study Participants

A prospective research design was used in the study. Participants were recruited prior to the twenty-eighth week of gestation and followed until the birth of their child. The study participants were 163 African-American pregnant women who were ages 16 to 35 and had no previous pregnancies that continued beyond 28 weeks. Subjects were free of diabetes mellitus and abnormal hemoglobins (sickle cell disease, thalassemia, and hemoglobin C). They were recruited from prenatal clinics operated by two urban hospitals and the Department of Health and Human Services (DHHS).

Data Collection

On entry into the study, participants were interviewed by trained personnel who collected sociodemographic data (age, marital status, educational level attained, and annual household income). Quantitative dietary data were collected monthly by using the 24-hour dietary recall method. Participants were recruited at various stages of their pregnancy; thus, the number of recalls varied from 1 to 7 days, with a mean of 2.6 days. We used three-dimensional food models and various measuring implements (measuring cups, spoons, etc.) to help participants recall how much foods and beverages were consumed the previous day. The Nutriplanner 6,000 System was used to calculate food and nutrient intake data *(42)*.

The use of illicit and nonillicit drugs was determined by self-reports and

biochemical analyses. After recruitment into the study, the women were asked whether they had used alcohol, cocaine, marijuana, heroin, opium, or PCP before and during pregnancy. Fasting venous blood samples were collected from the participants during each trimester: 1-13 weeks, 14-26 weeks, and 27 or more weeks. The prevalence of self-reported drug use before and during pregnancy was compared with the biochemical determination of drug use. Weeks of gestation at birth were established *(10)*.

Analyses for cocaine, marijuana, opium, or PCP were conducted on aliquots of serum collected from clotted blood samples that had been stored at -80°C. Participants' anthropometric measurements—pre-pregnancy weight (self-reported), maternal height, pregnancy weight gain, and delivery weight (based on measurements)—were obtained from their medical records. The initial semiquantitative testing of serum samples for illicit drug abuse was conducted by using the immune technique that is direct, automated, and enzyme-mediated *(48)*.

The classification of participants as drug users, trace drug users, or nondrug users was derived by using standards established by the Alcohol, Drug Abuse, and Mental Health Administration/National Institutes of Health Administration on Drug Abuse *(13)*. Women were classified as drug users (n=19) when their serum threshold levels were at least 300 ng/ml for cocaine, 100 ng/ml for marijuana, 300 ng/ml for opiates, or 25 ng/ml for PCP. Women were classified as trace drug users (n=122) when their sera tested positive for cocaine, marijuana, opiates, or PCP, but concentration levels were below the serum threshold levels for this group. Participants were classified as nondrug users (n=22) when their sera showed no evidence of cocaine, marijuana, opiates, or PCP.

Statistical Methods

Chi-square tests were used to compare sociodemographic characteristics, patterns of drug usage, and dietary practices of pregnant African-American women who were drug users, trace drug users, or nondrug users. Analysis of variance (ANOVA) and Duncan's multiple range *t* tests were used to investigate the relationships of substance abuse to dietary intakes and anthropometric measurements among the three groups of women. The computer Statistical Package for the Social Sciences (SPSS^x) was used to analyze the data *(50)*.

Results

Sociodemographic Characteristics and Self-Reported Drug Use

The pregnant African-American women were ages 16 to 35; most in each group were age 21 or younger: 58 to 68 percent (table 1). Most of the pregnant women were single (86 to 95 percent) and had at least a high school education (63 to 77 percent). Thirty-two to 53 percent of the women had an annual household income that was less than $23,000.

More than 25 percent of the pregnant women reported using illicit drugs before pregnancy; this number was more than eight times greater than the percentage of pregnant women reporting drug use during pregnancy (table 2). The most commonly abused drug reported both before and during pregnancy was marijuana, followed by cocaine. When interviewed, almost 97 percent of the pregnant women denied using drugs during pregnancy. However, biochemical determination of drug use showed that 88 percent of the pregnant women were classified as drug users or trace users.

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Table 1. Sociodemographic characteristics of pregnant African-American women

	Group 1 drug users	Group 2 trace drug users	Group 3 nondrug users
Participants (number)	19	122	22
	Percent		
Age groups (years)			
16-18	21.1	21.3	22.7
19-21	36.8	41.8	45.6
22-24	21.1	18.0	13.6
25-27	15.7	10.7	4.5
28-35	5.3	8.2	13.6
Marital status			
Single	94.7	87.0	86.4
Married	0	9.8	13.6
Other[1]	5.3	1.6	0
Not reported	0	1.6	0
Highest level of education attained			
Elementary school	0	0.8	0
Some high school	26.3	27.1	22.7
High school graduate	47.4	38.5	45.5
Trade school	0	5.7	9.1
College[2]	15.7	18.9	22.7
Other	5.3	0.8	0
Not reported	5.3	8.2	0
Annual household income			
<$11,000	15.7	29.5	13.6
$11,000 - $22,999	31.6	23.0	18.2
$23,000 - $34,999	15.8	9.0	13.6
≥$35,000	5.3	7.4	18.2
Not reported	31.6	31.1	36.4

[1]Separated, divorced, or cohabitating.
[2]One semester or more of college credits.
Sociodemographic characteristics among the three groups were not significantly different ($p > 0.05$).
Note: Biochemical assays were used to classify the three groups.

Among the two nonillicit drugs studied, cigarettes, compared with alcohol, were more likely to be used. Eighteen percent of pregnant women reported smoking cigarettes during pregnancy; most smoked 1 to 5 cigarettes per day. Four percent of the participants reported consuming alcohol during pregnancy, with regular beer being the most popular alcoholic beverage consumed (fig. 1). Chi-square analysis revealed no significant relationship between drug use and smoking or between drug use and consumption of alcoholic beverages. However, chi-square analysis did show a significant relationship between smoking and the use of alcoholic beverages ($p < 0.05$). This finding indicated that those who smoked were more likely to use alcoholic beverages (data not shown).

Energy and Nutrient Intakes Compared With Recommended Levels

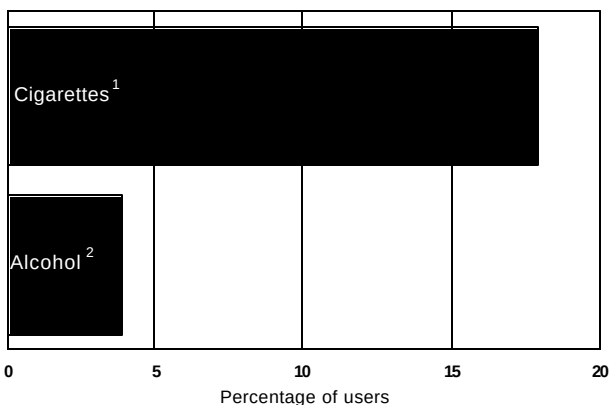
In contrast to *a priori* expectations, we found that the women who were classified as drug users had a mean energy intake that exceeded 100 percent of the 1989 recommended energy allowances: 101.1 percent *(41)* (table 3). The other groups of women had total kilocalorie intakes of less than 100 percent of these recommendations: 91 to 94 percent. The three groups of pregnant women had mean intakes of protein, ascorbic acid, thiamin, riboflavin, niacin, vitamin B_{12}, and phosphorus that met or exceeded 100 percent of the RDAs (table 4). For ascorbic acid and vitamin B_{12}, the intakes exceeded 200 percent of the RDAs: 211 to 259 percent. On the other hand, intakes of vitamin B_6, folate, calcium, iron, magnesium, and zinc were less than 100 percent of the RDAs: 26 to 82 percent. Drug users and trace drug users had mean intakes that exceeded 100 percent of the RDAs for vitamin A (127 to 151 percent), but

Table 2. Prevalence of self-reported drug use of African-American women before and during pregnancy

Self-reported drug use	Group 1 drug users	Group 2 trace drug users	Group 3 nondrug users
Participants (number)	19	122	22
		Percent	
Before pregnancy			
Marijuana	15.8	13.1	27.3
Cocaine, heroin, or PCP	10.6	13.0	0
During pregnancy			
Marijuana	0	1.6	4.5
Cocaine, heroin, or PCP	0	1.6	0

Self-reported drug use among the three groups was not significantly different ($p > 0.05$).
Note: Some individuals used more than one drug; therefore, percentages do not total 100.

Figure 1. Use of selected nonillicit drugs by African-American women during pregnancy



[1]Most smoked 1 to 5 cigarettes per day.
[2]Beer was the most popular alcoholic beverage.

nondrug users had vitamin A intakes below 100 percent of the RDAs (84 percent). However, the adequacy of food energy and nutrient intakes among the groups was not statistically significant.

Anthropometric Measurements

The anthropometric measurements were similar among the three groups of pregnant African-American women (table 5). For most of the measurements—pre-pregnancy weight, percentage of ideal pre-pregnancy body weight, body mass index (BMI), and delivery weight—the means were highest for drug users, compared with trace drug users and nondrug users. The differences, however, were not statistically significant.

Discussion and Conclusion

When the sociodemographic characteristics among three groups of pregnant African-American women were compared, no significant differences were noted. These findings were comparable to those reported in other studies that focused on the epidemiology of illicit substance abuse and nonillicit drug use. Similar studies depicted sociodemographic data that both confirmed *(17,33,36,51)* and contradicted *(2,46)* the findings in this study.

Our study showed that marijuana was the predominant drug of abuse, followed by cocaine. The pattern of illicit self-reported drug use in our study was similar to the self-reported pattern of drug use reported by others who found that marijuana and cocaine were more likely to be used, compared

with opiates *(4,17,25)*. It was not surprising that the prevalence of drug use that is based on self-reports was lower than the prevalence that is based on biochemical assays. The low prevalence of marijuana and cocaine use reported in this study may be due to the stigma associated with drug use, especially during pregnancy, as well as due to the fear of prosecution. When the participants in our study were interviewed, they reported a higher prevalence of substance abuse before pregnancy. This finding, which is confirmed by biochemical determination, is consistent with results of similar studies that showed women had been underreporting their use of illicit drugs when the interviews occurred during their pregnancies *(23,25)*. However, women may be more willing to disclose retrospectively information regarding illicit drug use during pregnancy when it is less likely they will be referred for treatment, threatened with loss of custody of their babies, or prosecuted *(23)*. Further, although self-reported data are often described as being inherently unreliable, the accuracy of self-reports vary considerably depending on the substance, time of the interview, skill of the interviewer, and other factors *(25)*.

One participant, determined by biochemical assays to be a nondrug user, admitted to being a current drug user. It is unlikely that a person would admit to being a current drug user when she is a nondrug user. Thus it is possible there is a flaw in the biochemical determination used in this study to determine current drug use. Current immunoassay methods and their routine threshold levels may not be sensitive enough to detect serum cocaine, marijuana, heroin, or PCP in pregnant women. Also, someone who tested negative for serum illicit drugs on a given day may be a heavy drug user who may have abstained from substance abuse for

Table 3. Energy intakes of pregnant African-American women, compared with the 1989 recommended energy allowances

	Group 1 drug users	Group 2 trace drug users	Group 3 nondrug users
Participants (number)	19	122	22
Total energy intake (kcal)	2527.0 ± 170.9	2347.0 ± 70.9	2270.8 ± 132.5
1989 Recommended Energy Allowances (%)	101.1	93.9	90.8

Energy intakes among the three groups were not significantly different ($p > 0.05$).
Note: Biochemical assays were used to classify the three groups.

Table 4. Nutrient intakes of pregnant African-American women, as percentages of the 1989 Recommended Dietary Allowances

	Group 1 drug users	Group 2 trace drug users	Group 3 nondrug users
Participants (number)	19	122	22
		Percent RDA	
Protein	176.7	160.7	163.3
Vitamin A	150.6	126.6	84.3
Ascorbic acid	238.2	210.6	226.3
Thiamin	126.7	115.8	99.5
Riboflavin	144.1	139.6	118.4
Niacin	139.0	135.2	127.2
Vitamin B_6	71.6	80.5	60.5
Folate	58.4	63.3	46.5
Vitamin B_{12}	259.0	254.1	251.8
Calcium	40.2	32.5	25.5
Phosphorus	131.5	112.0	103.7
Iron	50.8	52.5	44.9
Magnesium	81.7	75.2	62.8
Zinc	76.8	69.2	60.7

Nutrient intakes among the three groups were not significantly different ($p > 0.05$).
Note: Biochemical assays were used to classify the three groups.

Table 5. Maternal anthropometric measurements of pregnant African-American women

Anthropometric measurements	Group 1 drug users	Group 2 trace drug users	Group 3 nondrug users
Participants (number)	19	122	22
	Mean ± standard error		
Height (in.)	63.8 ± 0.6	64.4 ± 0.3	63.5 ± 0.6
Pre-pregnancy weight (lbs.)	144.3 ± 8.7	139.5 ± 3.0	138.4 ± 5.4
Ideal body weight (%)	120.3 ± 6.9	114.2 ± 2.3	117.4 ± 5.4
Body mass index (BMI) (kg/m_2)	24.9 ± 1.4	23.7 ± 0.5	24.4 ± 1.2
Weekly weight gain (lbs.)	0.7 ± 0.1	0.7 ± 0.04	0.6 ± 0.08
Total weight gain (lbs.)	30.0 ± 4.6	31.1 ± 2.4	24.7 ± 2.8
Delivery weight (lbs.)	173.0 ± 9.0	170.7 ± 3.8	164.4 ± 7.1

Maternal anthropometric measurements among the three groups were not significantly different ($p > 0.05$).
Note: Biochemical assays were used to classify the three groups.

Among the two nonillicit drugs studied, cigarettes, compared with alcohol, were more likely to be used.

several days preceding the drug test. Thus a negative drug test will be read. In addition, lack of agreement between self-reports and biochemical determination of illicit drug use could be partly due to the relatively short half-life of most of these illicit drugs. The half-life of cocaine in the plasma after oral ingestion or inhalation is 1 hour. For marijuana, plasma concentration peaks within 7 to 10 minutes; physiological effects are shown between 20 and 30 minutes. The half-life of PCP appears to be about 3 days, but it could be shortened to 1 day by gastric suction and acidation of urine *(21)*.

Our finding that participants who smoked cigarettes were more likely to consume alcoholic beverages, compared with those who did not smoke, is consistent with results of similar studies *(3,20,25,56)*. Other studies showed that women who drank alcohol during pregnancy were more likely to smoke cigarettes and use illicit drugs, to have parents who drank alcohol, or to feel that other pregnant women drank similar amounts of alcohol *(25)*.

The energy intakes of participants in our study, as a percentage of the recommended energy allowances *(41)*, were higher than those recorded by other investigators *(7,12,44)*. In a similar study, researchers found that women reporting drug use before pregnancy had significantly higher intakes of food energy than did their counterparts who were using drugs during pregnancy *(27)*. The protein intakes of the participants in our study exceeded 161 percent of the RDA and are consistent with those of other studies *(7,49)*. Another study, however, reported protein intakes of less than 100 percent of the RDA for the pregnant participants who used illicit drugs (*12)*.

Other studies (*24*,*34*,*49*) also supported our findings of relatively high intakes of vitamin A among pregnant participants. The 1989 RDA for ascorbic acid for pregnant women is 70 mg *(41)*. Overall, our findings regarding the intakes of the selected B vitamins (thiamin, riboflavin, niacin, and B_{12}) are supported by other studies that consistently reported intakes of selected B-complex vitamins as being at least 100 percent of the RDAs *(12,49)*. Vitamin B_6 intakes of our study participants did not meet the 1989 RDAs for all three groups of women, a finding supported by other studies *(12,49)*. Women in our study consumed folate in amounts substantially less than the RDA. Several studies that reported average nutrient intakes by pregnant women, compared with the RDAs, recorded mean folate intakes below the RDA *(12,24)*.

Calcium, iron, magnesium, and zinc intakes for all three groups of women in our study were less than 83 percent of the 1989 RDAs. Other studies had similar findings *(7,12,24,49,53)*. In our study, phosphorus was the only mineral that exceeded 100 percent of the 1989 RDA.

Some of the food composition databases lacked information on nutrients that may be present in the diets of pregnant women at levels that are substantially less than recommended. These nutrients include vitamins B_6, B_{12}, D, and E, and some minerals (including zinc, magnesium, and copper) *(41)*. This may explain partially why the aforementioned nutrients are among those that are reported to be consumed consistently in amounts substantially less than the RDAs.

In our study, body mass index (BMI) values were considered normal—according to the guidelines that consider BMI values between 18.5 and 24.9 as normal *(38)*. BMI is a preferred indicator of nutritional status because it depends on two commonly and easily measured aspects of morphology—weight and height*(52)*.

A large study of 3,946 White non-Hispanic mothers reported BMI values up to 26 *(28)*. Similarly, another study depicted a wider range of BMIs from underweight to obese for their pregnant participants *(43)*. Pregnancy guidelines recommend that women of normal pre-pregnancy weight should gain between 25 and 35 pounds, while underweight and overweight women should gain between 35 and 40 and 15 and 25 pounds, respectively *(31)*. The mean gestational weight gains of the participants in our study were within the normal ranges. Other investigators reported similar mean gestational weight gains for their participants *(5,26,54,55)*.

Pre-pregnancy weight-for-height status is among factors that investigators have linked with gestational weight gain *(52)*. Weights determined at the first prenatal visit during the first trimester of pregnancy have been used to estimate total weight gain and early gestational weight gain, but these weights do not necessarily reflect pregnancy weights. Although average weight gain in the first trimester is small relative to that in the second and third trimesters, individual variation may be considerable. Total gestational weight gains may be overestimated by self-reports or underestimated if based on weight in the latter part of the first trimester *(52)*. The Subcommittee on Nutritional Status and Weight Gain During Pregnancy suggests that African-American women should strive to gain weight at the upper end of the target weight range *(52)*.

Compared with their counterparts, women addicted to recreational drugs are at a higher risk of experiencing a variety of obstetrical complications that may increase perinatal morbidity for mother and child *(6)*. Preventing these effects should be based on thorough information about this segment of the population—probably via unbiased longitudinal studies. Prevention of these deleterious effects should also be based on careful medical control of the nutrition of these mothers, their health and social conditions during gestation, and the treatment of their addiction before and during pregnancy*(36)*.

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