Relation between Vegetarian/Nonvegetarian Diets and Blood Pressure in Black and White Adults

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Abstract: We examined the possible interaction of race and diet on blood pressure (BP) in volunteer Black Seventh Day Adventists compared to volunteer White church members. Height, weight, waist and hip circumference, and resting seated BP were recorded in Black vegetarians (n = 55; age: 54.7 ± 16.9 yrs), Black nonvegetarians (n = 59; 56.1 ± 14.1 yrs), White vegetarians (n = 164; 52.2 ± 16.7 yrs), and White nonvegetarians (n = 100; 52.6 ± 15.6 yrs) attending a regional conference. Forty-four percent of the Black nonvegetarians were medicated hypertensives, compared to only 18 percent of the Black vegetarians, 7 percent of the White vegetarians, and 22 percent of the White nonvegetarians. Black vegetarians exhibited lower age and sex-adjusted systolic BP ($\bar{x}$ = 122.9/74.4 mm Hg) than Black nonvegetarians ($\bar{x}$ = 132.2/75.9 mm Hg). After further adjusting BP for body mass index and waist/hip ratio, the systolic BP among Black vegetarians remained lower (122.8) than Black nonvegetarians (129.7) but higher than that of the Whites who showed no diet-related BP differences. (*Am J Public Health* 1989; 79:1283–1288.)

Introduction

Several dietary constituents including sodium,[1–3] total calories,[4] saturated fat,[5] and alcohol[6,7] have been shown to be positively related to blood pressure (BP). Potassium,[8] calcium,[9,10] magnesium,[11] polyunsaturated fat,[12] and fiber[13] appear to be inversely related to BP. The vegetarian diet tends to be low in the factors positively related to BP, and high in the protective factors (except for calcium in the diet of strict vegetarians who consume no dairy products). Cross-sectional studies of White adults in Australia,[14–16] Israel,[17] and the United States[18–20] have found lower BP among vegetarians than nonvegetarians. Estimates from these studies of the magnitude of the blood pressure differences attributable to diet may be inaccurate because of the lack of random selection of subjects, and group differences in the use of alcohol, caffeine, and tobacco; physical activity; psychosocial stress; weight,[21] body mass index (BMI),[16,19] or anatomic location of body fat.[22] Despite the shortcomings of these observational studies, several experimental studies have been conducted which demonstrate a modest BP-lowering effect when omnivores are switched to a vegetarian diet.[23,24] In these trials a placebo effect cannot be excluded since subjects were not blind to the type of diet consumed.

Whether the vegetarian diet protects against elevated BP has not been studied in US Black adults, a population with a high prevalence of hypertension, possibly due to genetic susceptibility.[25] We compared BP in a group of Black adults following a vegetarian diet to that of a group of Black nonvegetarians. We also explored the possible interaction of dietary preference and race by examining BP in a sample of White vegetarians and nonvegetarians. To reduce the confounding effects of alcohol, caffeine, and tobacco, we studied members of the Seventh Day Adventist Church which encourages avoidance of these substances.

Methods

Subjects

Subjects for this study were volunteers from members of the Seventh Day Adventist Church, who were in attendance at either of two conferences which took place in Michigan during July 1987. The first conference was composed of mostly Black conferees from the midwest region of the US and the second was attended primarily by White church members.

All of the Blacks attending the first conference were requested to participate in this study. Conferees were informed that the purpose of the study was to examine the relation between health habits and health risks. Anonymity and confidentiality were assured; the study was approved by the Committee for the Protection of Human Subjects at Purdue University. Because hypertensives and the elderly might have been more prone to participate, special effort was made to inform the Black conferees that *all* adults were requested to participate, regardless of age or health status. Approximately 50 percent of the Black women volunteered, compared to 20 percent of the Black men. Table 1 provides the demographic characteristics of the 114 Black study participants (89 females, 25 males).

In order to obtain a comparable group of White Adventists, with a sex distribution similar to that of the Black sample, a gender-stratified random sample was recruited from those in attendance at the second conference. From the 400 randomly selected subjects (approximately 80 percent women, 20 percent men) 264 agreed to participate. The characteristics of the 264 White subjects (222 females, 42 males) are also included in Table 1. The average age for all four groups was between 52 and 57 years, and the majority of individuals in each group were long-time church members. The Whites had a longer family history of Adventist church membership than the Blacks, and the White vegetarians had slightly more years of formal education than the other three groups. The average length of adherence to a meatless diet was 20.6 years for Black vegetarians (n = 55) and 27.2 years for White vegetarians (n = 164). Black nonvegetarians (n = 59) averaged 10.1 ± 1.9 ($\bar{x}$ ± SEM) three-ounce servings of meat, poultry, and fish per week, while White nonvegetarians (n = 100) consumed 3.6 ± 0.4 servings of flesh food per week.

Dietary Measures

Subjects were given a comprehensive health questionnaire adapted from previous studies[19,20] and scheduled for measurement of BP and anthropometric characteristics within a four-day period. Subjects categorized themselves as vegetarian (no consumption of meat, fish, or poultry) or nonvegetarian and answered a food frequency questionnaire (Right Byte Nutritionist III, N-Squared Computing, Silverton, Oregon) composed of 141 food items and related food

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TABLE 1—Demographic Characteristics of Black and White Vegetarians (VEG) and Nonvegetarians (NVEG) ($\bar{x}$ ± SEM)

	Black Adventists		White Adventists	
	VEG (n = 55)	NVEG (n = 59)	VEG (n = 164)	NVEG (n = 100)
Age (yrs)	54.7 ± 2.3	56.1 ± 1.8	52.4 ± 1.3	52.6 ± 1.6
Education (yrs)	12.8 ± 0.52	12.8 ± 0.4	13.9 ± 0.2	12.5 ± 0.2
Church member (yrs)	28.7 ± 2.5	29.2 ± 2.6	37.0 ± 1.4	31.2 ± 1.8

groups, to which the subjects reported the amount and frequency of their usual consumption during the previous three months. Included among the listed food items in the instrument are several commercially prepared soy-protein meat analogs frequently used by Seventh Day Adventists. Dietary responses were analyzed using the data base from US Department of Agriculture[26]; macro- and micronutrient intakes were estimated for each subject. Complete dietary data were obtained for 352 of the 378 respondents.

Blood Pressure Measurement

Following a five-minute rest, two seated BP measurements were taken for each subject using a random-zero mercury sphygmomanometer (Hawksley and Sons, Ltd., London) by trained personnel blind to the subject's dietary preference. The second BP measurement was taken two minutes after the first. The first and fifth phase Korotkoff sounds were recorded as systolic and diastolic pressure, respectively. The average of the two BP measurements was used for statistical analyses, regardless of the subject's use or non-use of antihypertensive medications. Subjects were not informed of their BP values until both measurements were recorded.

Anthropometric Measurements

Following the BP measurements, height, weight, triceps skinfold, and waist and hip circumference were assessed. Height without shoes was measured to the nearest one-quarter inch using a stadiometer and converted to centimeters. Subjects were weighed wearing lightweight summer clothing on a balance beam scale. Two triceps skinfold measurements were taken using a Lange skinfold caliper (Cambridge Scientific Industries, Cambridge, MD) and the average was used for statistical analyses. Waist circumference was measured in centimeters using a nonstretchable tape at a level estimated to be midway between the xyphoid process of the sternum and the umbilicus in women, and at the level of the umbilicus in men. Hip circumference was measured in centimeters at the widest hip girth. All circumference measurements were taken without removal of subjects' clothing.

Statistical Analyses

All statistical analyses were made using the Statistical Analysis System (SAS, Cary, NC). Group means of demographic data and anthropometric characteristics were compared using the one-way analysis of variance procedure. Blood pressure data were analyzed with a two-way (diet by race) analysis of covariance, using age, gender, BMI (Wt/Ht^2), waist/hip ratio, and family history of hypertension as covariates. Frequency data were analyzed using the Chi Square statistic. Relationships between variables were examined using simple and multiple correlational analyses.

Results

Intake of macronutrients and several micronutrients of interest are revealed in Table 2. Macronutrient differences between vegetarians and nonvegetarians were as expected, with vegetarians exhibiting lower intakes of protein and fat and higher intakes of carbohydrates. Dietary differences were greater between Black vegetarians and nonvegetarians, than between White vegetarians and nonvegetarians.

As shown in Table 3, Black nonvegetarians exhibited significantly greater body weight, BMI, and waist and hip circumference than the other three groups. The differences

TABLE 2—Estimated Macro and Micronutrient Intake* of Black and White Vegetarian (VEG) and Nonvegetarian (NVEG) Adults ($\bar{x}$ ± SEM)

	Black Adventists		White Adventists	
	VEG (n = 51)	NVEG (n = 49)	VEG (n = 163)	NVEG (n = 89)
Kcalories	2406 ± 130	2504 ± 180	2340 ± 66	2225 ± 92
Protein (g)	66.8 ± 4.9	97.1 ± 9.3	79.9 ± 2.4	80.8 ± 3.4
Protein (kcal%)	12.4 ± 0.4	14.6 ± 0.5	13.0 ± 0.2	14.1 ± 0.3
Carbohydrate (g)	300.5 ± 20.4	321.6 ± 22.5	351.0 ± 9.6	298.3 ± 11.8
Carbohydrate (kcal%)	56.1 ± 1.2	51.0 ± 1.2	57.2 ± 0.6	52.1 ± 7.3
Fat (g)	74.9 ± 5.8	102.7 ± 8.8	82.5 ± 3.2	89.1 ± 4.8
Fat (kcal%)	31.4 ± 1.3	34.5 ± 1.1	29.7 ± 0.6	33.7 ± 7.0
CHOL (mg)	99.4 ± 14.5	294.2 ± 42.0	149.6 ± 9.4	220.1 ± 13.9
Crude Fiber (g)	10.8 ± 1.0	10.2 ± 1.2	13.2 ± 0.6	9.6 ± 0.7
Nondiscretionary				
Sodium (mg)	2385 ± 197	2833 ± 232	2815 ± 87	2841 ± 133
Potassium (mg)	3721 ± 253	3938 ± 303	4553 ± 129	3945 ± 169
Calcium (mg)	820 ± 79	960 ± 73	1113 ± 45	1103 ± 50
Phosphorus (mg)	1219 ± 101	1534 ± 118	1646 ± 51	1526 ± 59
Magnesium (mg)	368 ± 28	379 ± 29	468 ± 14	364 ± 14

*Nutrient intake estimated from 141-item food frequency questionnaire used to measure habitual intake during the previous three months.

TABLE 3—Anthropometric Characteristics of Black and White Vegetarians (VEG) and Nonvegetarians (NVEG) ($\bar{x}$ ± SEM)

	Black Adventists		White Adventists	
	VEG (n = 55)	NVEG (n = 59)	VEG (n = 164)	NVEG (n = 100)
Weight (Kg)	70.6 ± 1.6	83.0 ± 2.1	65.2 ± 1.1	71.7 ± 1.6
Body Mass Index (Wt/Ht^2)	26.3 ± 0.5	31.4 ± 0.9	24.6 ± 0.4	27.4 ± 0.6
Waist circumference (cm)	82.4 ± 1.5	92.6 ± 1.8	80.7 ± 1.0	86.8 ± 1.5
Hip circumference (cm)	102.5 ± 1.1	111.8 ± 1.7	101.2 ± 0.8	106.4 ± 1.2
Waist/hip (WHR)	0.80 ± 0.01	0.83 ± 0.01	0.79 ± 0.01	0.81 ± 0.01
Triceps skinfold (mm)	22.1 ± 1.4	32.0 ± 1.9	24.3 ± 0.8	31.1 ± 1.3

between Black vegetarians and nonvegetarians were greater than the differences between the corresponding White groups.

None of the subjects reported current use of cigarettes or tobacco in any form. None of the Black participants consumed alcohol, and only two White nonvegetarians and one White vegetarian reported any use of alcohol. Caffeine consumption averaged less than 45 mg per day for all four groups. Reported levels of occupational physical activity were not different between the four groups. However, Black nonvegetarians reported lower frequency of participation in leisure-time exercise ($\bar{x}$ ± SEM = 1.4 ± 0.3 sessions per week of aerobic exercise lasting at least 20 minutes per session, compared to the Black vegetarians (2.6 ± 0.3), White vegetarians (2.5 ± 0.2), and White nonvegetarians (2.0 ± 0.2).

Forty-four percent of Black nonvegetarians reported use of physician-prescribed antihypertensive medication compared to only 18 percent of the Black vegetarians, 7 percent of the White vegetarians, and 22 percent of the White nonvegetarians. A higher percentage of Black nonvegetarians (76.3 percent) reported a history of hypertension among their immediate family members (children, siblings, and/or parents) compared to Black vegetarians (55.6 percent), White vegetarians (45.1 percent), and White nonvegetarians (55.0 percent).

Table 4 shows the age- and sex-adjusted systolic and diastolic BP for the four groups. The p-values for main effects of race (Black vs White) and diet (vegetarian vs nonvegetarian) were both less than 0.05 for systolic BP, and there was a weak race by diet interaction ($p = 0.08$). Black vegetarians had lower systolic BP (122.9) than Black nonvegetarians (132.2) but higher than both White vegetarians (113.6) and White nonvegetarians (116.2). Diastolic BP varied with race but not diet. Adding body mass index and waist/hip ratio as covariates, either alone or in combination, attenuated the BP differences between the vegetarians and nonvegetarians, although the patterns are very similar to those adjusted only for age and sex. The addition of family history of hypertension as another covariate in the model did not significantly alter these results for either systolic or diastolic BP.

Table 5 displays the simple correlation coefficients for BP and selected subject characteristics. Age and anthropometric measures were the best single predictors of systolic BP among both the Black and White groups. Waist/hip ratio was a better predictor of both systolic and diastolic BP than was BMI. None of the macro and micronutrient intakes contained in Table 2 (expressed in absolute amounts or per 1000 Kcal) were significantly correlated with BP ($p < 0.01$), nor was the sodium/potassium ratio. For the correlation analyses, the variable "diet" was expanded to four levels by classifying individuals according to four dietary categories based on use of foods derived from animal sources: strict vegetarian; lacto-ovo or lacto vegetarian; prudent diet (use of milk and eggs, and flesh foods no more than three days per week); and omnivorous diet (liberal use of milk and eggs, and flesh foods on a regular basis). Among Blacks, diet was positively

TABLE 4—Adjusted Systolic and Diastolic Blood Pressure for Black and White Vegetarians (VEG) and Nonvegetarians (NVEG) ($\bar{x}$ ± SEM)

	Black Adventists		White Adventists	
	VEG (n = 55)	NVEG (n = 59)	VEG (n = 164)	NVEG (n = 100)
Blood Pressure Adjusted for Age and Sex				
Systolic BP (mmHg)[a]	122.9 ± 2.3	132.2 ± 2.2	113.6 ± 1.3	116.2 ± 1.7
Diastolic BP (mmHg)[b]	74.4 ± 1.3	75.9 ± 1.2	66.2 ± 0.7	67.7 ± 0.9
Blood Pressure Adjusted for Age, Sex, Body Mass Index, and Waist/Hip Ratio				
Systolic BP (mmHg)[c]	122.8 ± 2.2	129.7 ± 2.2	114.7 ± 1.3	115.0 ± 1.6
Diastolic BP (mmHg)[d]	74.2 ± 1.3	74.8 ± 1.3	66.7 ± 0.7	67.2 ± 0.9

[a]Main effects of diet ($F = 9.8$, $p < 0.01$)
Main effects of race ($F = 43.8$, $p < 0.001$)
Diet × race interaction ($F = 3.03$, $p = 0.08$)
White VEG, White NVEG < Black VEG < Black NVEG (Least Squared Differences, $p < 0.05$)
[b]Main effects of diet ($F = 2.1$, $p = 0.15$)
Main effects of race ($F = 59.4$, $p < 0.001$)
Diet × race interaction ($F = 0$, $p = 0.98$)
[c]Main effects of diet ($F = 3.51$, $p = 0.06$)
Main effects of race ($F = 35.24$, $p < 0.001$)
Diet × race interaction ($F = 3.20$, $p = 0.07$)
White VEG, White NVEG < Black VEG < Black NVEG (Least Squared Differences, $p < 0.05$)
[d]Main effects of diet ($F = 0.28$, $p = 0.59$)
Main effects of race ($F = 49.81$, $p < 0.001$)
Diet × race interaction ($F = 0$, $p = 0.98$)

TABLE 5—Correlations of Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP) with Selected Subject Characteristic of Blacks, Whites, and Combined Races

	Black (n = 114)		White (n = 264)		Combined Races (n = 378)	
Variable	SBP	DBP	SBP	DBP	SBP	DBP
Age	.46[d]	.12	.47[d]	.05	.47[d]	.11[a]
Gender*	.00	−.07	−.18[b]	−.07	−.13[a]	−.10
Body Mass Index	.23[a]	.10	.30[d]	.24[d]	.33[d]	.26[d]
Waist/Hip	.35[d]	.35[d]	.43[d]	.18[b]	.40[d]	.25[d]
Waist	.38[d]	.28[b]	.40[d]	.24[d]	.42[d]	.29[d]
Hip	.24[a]	.08	.23[d]	.20[c]	.27[d]	.21[d]
Triceps skinfold	.08	−.07	.09	.15[a]	.09	.07
Exercise frequency**	−.18[a]	−.09	.05	−.02	−.06	−.07
Diet†	.23[a]	.10	.07	.09	.18[c]	.15[c]
Family history of HT††	.01	.00	.16[b]	.18[b]	.16[b]	.17[c]
Race‡	—	—	—	—	−.34[d]	−.39[d]
Education	−.18[a]	−.18[a]	−.20[b]	.05	−.21[d]	−.09
Calcium	.13	.17	−.08	.00	−.06	−.02
Sodium	.07	.13	−.05	.02	−.03	.03
Sodium/Potassium	−.01	.10	−.01	−.05	.00	.01
Polyunsaturated fat/ saturated fat	−.12	−.13	.06	.09	.04	.06

[a]$p < 0.05$
[b]$p < 0.01$
[c]$p < 0.001$
[d]$p < 0.0001$
*Gender (male = 1, female = 2)
**Exercise Frequency (no exercise = 0, times per week = 1, 2, 3 . . .)
†Diet (strict vegetarian = 1, lacto-ovo vegetarian = 2, prudent diet = 3, omnivorous diet = 4)
††Family history of hypertension (no = 1, yes = 2)
‡Race (Black = 1, White = 2)

associated with BP in the simple correlation analyses, but was not among the Whites, possibly owing to their more homogenous diet.

Stepwise multiple regression analysis was performed using variables significantly related to BP in the simple correlation procedure as well as dietary intake of fat, total fat, sodium, potassium, sodium/potassium ratio, calcium and magnesium. Age, race, waist circumference, and family history of hypertension were the best predictors of systolic BP for all subjects. Race, waist circumference, and family history of hypertension were the best predictors of diastolic BP. The unadjusted positive correlation between diet and BP was partly explained by the effects of waist circumference and waist/hip ratio. None of the specific nutrients significantly contributed to the prediction of blood pressure in the multiple regression analysis.

Discussion

The results obtained from the Black participants in this study parallel those of several previous studies of White adults showing that vegetarians exhibit lower BP than nonvegetarians independent of differences in anthropometric characteristics.[14–17] Systolic BP differences between the two Black groups would likely have been even greater had not significantly more Black nonvegetarians had their high BP attenuated by use of antihypertensive medications compared to the Black vegetarians. The lack of significant differences in BP between the White dietary groups may have been the result of inadequate dietary heterogeneity. White Adventist nonvegetarians eat a more prudent diet than the usual omnivore, as evidenced in this study by their average consumption of only three to four, three-ounce servings of meat, fish, or poultry per week, fewer than 300 mg dietary cholesterol per day, and less than 34 percent of calories as fat. Indeed their diet is more similar to the vegetarian diet than that of omnivores in previous studies.

Dietary differences were greater between the Black vegetarians and nonvegetarians which may explain the lower systolic blood pressure in the former, even after adjustment for anthropometric characteristics. The positive association between systolic blood pressure and diet (at four levels of animal food consumption) provides supporting evidence. Possibly the systolic blood pressure difference between Black dietary groups was related to better blood pressure control among the medicated Black hypertensive vegetarians ($\bar{x}$ BP = 136/74) compared to Black nonvegetarians on antihypertensive therapy ($\bar{x}$ BP = 145/79). However, all but two hypertensive subjects (one vegetarian and one nonvegetarian) reported adherence to prescribed medications. Other studies suggest the vegetarian diet may reduce the effective drug dosage for medicated hypertensives.[27]

Despite similarities in age, anthropometric characteristics, exercise habits, and reported levels of stress, Black vegetarians still exhibited a higher prevalence of diagnosed hypertension and a higher average systolic and diastolic blood pressure than White vegetarians. In comparison to White vegetarians, the Black vegetarians had significantly lower mean intakes of potassium, calcium, vitamin D, and magnesium, all of which have been reported to be inversely related to blood pressure.[8–11,28,29] However, the correlational analyses provide no support for their contribution to the blood pressure differences. The absence of a clear nutrient effect, while somewhat puzzling, has also characterized other studies of vegetarian diet and blood pressure. Limitations of questionnaire data are an obvious source of some misclassification, but even controlled dietary trials by Sacks, *et al*,[30] have had difficulty in identifying specific foods and nutrients responsible for the lower blood pressure among vegetarians. They concluded that lower intakes of total fat,

saturated fat, and animal protein, and higher intakes of carbohydrates, polyunsaturated fatty acids, and vegetable protein do not alone explain the lower blood pressure in vegetarians compared to nonvegetarians. In addition, based on experimental findings, Margetts, *et al*,[31] have concluded that the vegetarian diet does not affect blood pressure by way of its high fiber content.

The Australian research group, which has performed numerous studies regarding diet and blood pressure, finds strong evidence for an independent blood pressure-lowering effect of a vegetarian diet, but considerable uncertainty as to the nutrients responsible for this effect.[32] Multiple nutrients may act in concert, with the effect on blood pressure due to the totality of the vegetarian diet, rather than single dietary constituents. Cross-sectional analyses commonly find little or no correlation between specific nutrients such as sodium and blood pressure.[33] This may be partly explained in our study by attempting to relate only current nutrient intake (previous three months) to blood pressure when habitual nutrient intake over several years or even decades would appear to have a stronger influence on blood pressure. The inclusion in the regression analysis of BP values achieved by use of antihypertensive medication could also mask significant dietary correlates of blood pressure. Although attempts were made to minimize non-dietary group differences by sampling only from among Adventist church members, possibly self-selected vegetarians differ systematically from nonvegetarians in attributes not measured in this study, which might be important determinants of blood pressure.

Among both Black and White Adventists, central adiposity as estimated by waist circumference or waist/hip ratio was a stronger predictor of blood pressure than was BMI or peripheral adiposity estimated by triceps skinfold or hip circumference. Dietary preference was related to fat patterning with vegetarians of both races exhibiting less central deposition of fat as estimated by waist circumference and waist/hip ratio. The lower weight and adiposity among Black vegetarians compared to nonvegetarians appears to be at least partly explained by differences in caloric intake and frequency of exercise. However, White vegetarians were significantly leaner than White nonvegetarians despite similar intake of calories and reported exercise frequency. Factors other than total caloric intake and physical activity are known to influence body weight including dietary composition, resting metabolic rate, postprandial thermogenesis, and adaptive thermogenesis.[34] Virtually all studies to date have reported vegetarians to weigh significantly less than nonvegetarians, yet the specific reasons for this difference are unclear. A recent study from our laboratory suggests the lower body weight of vegetarians is not due to higher resting metabolic rate or postprandial thermogenesis compared to nonvegetarians.[35]

In summary, it appears that while there is a relationship between dietary preference and blood pressure in Black adults, the vegetarian diet does not completely attenuate their apparently greater susceptibility to hypertension compared to Whites. However, from a public health perspective, the vegetarian diet appears to have implications for the primary prevention of hypertension and obesity for both Black and White adults. Because such a diet is not easily adopted by the majority of adults in the US, future research must continue the search for the specific dietary factors which afford protection against abnormal elevation of both blood pressure and body weight.

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Births to Older US Women: NCHS Report

Detailed statistics on first births to older US women are now available from the National Center for Health Statistics in a new report, *Trends and Variations in First Births to Older Women, 1970–86*. Statistics in the report focus on the decline in childbearing among well-educated women in their twenties, and the extent to which these women have delayed motherhood. Maternal and infant health characteristics are also analyzed. Highlights of the report include:

- First births to women in their thirties have increased substantially since 1970, quadrupling their levels in a 16-year period. Throughout the 1970s, the increases were largest for women ages 30–34 years. Since 1980, the impact of this phenomenon has shifted to older women. Between 1980 and 1986, the increases in first births and first-birth rates were much greater for women ages 35–39 years.
- During this period of rapidly rising first-birth rates for women in their thirties, rates for women in their teens and early twenties declined.
- The number of women in their thirties grew substantially during this period—all born in the post World War II baby boom years.
- Women aged 30 and older accounted for 15 percent of all first births in 1986 compared with just 4 percent in 1970.
- Unmarried women accounted for about one in 10 first births to mothers ages 30–34 in 1986 compared with one in 20 a decade earlier.
- The educational attainment of women having their first child at ages 30 and older has increased substantially, and is higher than for women in any other age group. During the 1980s, close to one-half of the older first-time mothers have been college graduates, compared with one-fourth of comparable women in 1970.
- Greater educational attainment is associated with more timely receipt of prenatal care and a better outcome in terms of birthweight. More than 90 percent of mothers in their thirties who were college graduates began prenatal care in the first trimester. Only 5.8 percent of first births to college graduates ages 30–34 were low birthweight in 1986 compared with 7.5 percent of all first births to mothers in this age group.

For further information or copies of the report, contact: Sandra Smith, Public Information Officer, NCHS, 301/436-7135; or Stephanie Ventura, Statistician, Natality, Marriage and Divorce Statistics Branch, 301/436-8954.