Published in final edited form as:
Ethn Dis. 2012 ; 22(3): 360–366.

Effects of Parity on Blood Pressure among West African Dogon Women

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Abstract

Objective—This study examined the effect of parity on blood pressure (BP) readings and BMI among rural West African Dogon women.

Design—Correlational research design.

Setting—Sangha, West Africa

Participants—133 West African Dogon Women

Methods—Demographic survey including age, number of children, history of hypertension, and village affiliation. BP readings were taken in accordance with JNC-7 guidelines. BMI was calculated from height and weight.

Results—Women with BP readings diagnostic of hypertension were typically older ($M = 55.72$ years) than those who were normotensive ($M = 42.40$). However, BMI, on average, was within normal range for both groups (22.81 and 22.15, respectively). A statistically significant difference was found between number of children and systolic BP (SBP), $P = .015$, with those having 5 or more children with higher SBP than those with one to three children. A statistically significant difference, $P = .001$, was found between hypertension and normotensive diagnostic groups.

Conclusions—This study shows that increased parity of five or more children may contribute to West African Dogon women's risk factors for hypertension in terms of increased SBP. Because BMI was within normal range for both groups of women, it was not shown to be an independent risk factor for hypertension in this sample. Further studies, with larger samples followed throughout their childbearing years (before, during, and after each pregnancy), are needed before more definitive conclusions can be made regarding the effects of parity on BMI and BP among rural West African Dogon women.

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Supervision: J Taylor

Keywords

Parity; Women; Dogon; Rural; Hypertension; West African

Introduction

It is well-accepted that African American women have the highest prevalence of hypertension than any other ethnic group.[1–2] Some risk factors for hypertension development that have been identified universally include, but may not be limited to: diet high in sodium and cholesterol, physical inactivity, overweight, and obesity. Excessive gestational weight gain increases the likelihood of postpartum weight retention and contributes to maternal and offspring long-term obesity and associated increase in the risk for hypertension.[3–5] In a recent study of gestational weight gain and postpartum weight loss, researchers reported an average baseline prepregnancy body mass index (BMI) ≥ 30 (obese) in African American women.[6] Further, among obese women at baseline, postpartum weight gain retention beyond the first year after delivery in African American women exceeded that of Latina/Hispanic and Caucasian women.[6] With the increasing rate of obesity and hypertension among women at younger ages, the impact on negative pregnancy outcomes represents a threat to public health.

Barksdale and Metiko investigated the role of parental history as a predictor of hypertension risk among African Americans.[7] Parental hypertension was correlated with the development of obesity and hypertension among adult children at younger ages, increasing the likelihood of these comorbidities coinciding with childbearing age and risks associated with pregnancy. Miranda et al reported that age also was a significant predictor of hypertension, with blood pressure increases associated with increasing maternal age among Black women.[8]

One potential risk factor that has been understudied is the effect the numbers of pregnancies and birth have on blood pressure readings of women later in life. Few studies have reported findings of the association between parity and hypertension development over the lifespan, particularly among Black women. Ness et al published a comprehensive review on parity and hypertension and concluded that women with five or more children had significantly higher blood pressure readings than those with fewer live births.[9] They also noted that BMI and age were significant risk factors for women with five or more children because they tended to be older and heavier than those with fewer children.[9] A study of urban Detroit women had similar findings, indicating that those with five or more children were also older, heavier, and had significantly higher systolic blood pressure readings than those with less than five children.[10] In our study, we sought to advance the science by addressing the significant gap in knowledge regarding the influence of parity on blood pressure and body mass index (BMI).

Purpose

The purpose of our study was to replicate what had been done in an urban African American sample,[10] using a rural West African sample to determine if parity is related to increased BMI and hypertension development in Black women. Western and west-central Africa represents the geographic origin of many descendants of African slaves, arriving in the United States through forced migration. Many of the African slaves were brought to southern United States to work on the sugar, rice, cotton, and tobacco plantations. While admixture has occurred over the last two centuries, population-specific DNA markers provide a means to identify ancestral origin among African Americans.[11] Parra et al reported the European genetic contribution of 16.3% in a population from Detroit,[11] a city

representing a major urban destination of migrating African Americans from the rural South after World War 1.

The lifestyle of rural West African Dogon women naturally controls for lifestyle factors, such as diet and physical activity. Because the lifestyle factors and geographic locations differ drastically between rural Dogon women and urban African American women, our study may be able to more accurately determine if effects of parity and BMI on blood pressure are consistent within the two groups of women (urban African American women from Detroit and West African Dogon women). Our study examined the effects of age and parity on blood pressure readings and BMI among West African Dogon women with children and answers the following research question: Does age and parity affect blood pressure readings and BMI among rural West African Dogon Women?

Methods

Participants

Our study was correlational in design and included 133 West African women who reported having at least 1 child and lived in the Dogon region of Mali. Recruitment strategies commenced after approval from the institutional review board (IRB) of the University of Michigan (HUM0000 1147) and approval letter from the Mali government.

The investigators and research assistants recruited West African women who lived in the Dogon tribes of Sangha, Mali. The following recruitment procedures were used: a) an educated native Dogon man who was well versed in both Dogon and western European culture was hired as a translator to request verbal permission from the chief of each village; b) once permission was granted, a date and time was set to visit the village; c) upon arrival at the village, the translator explained the study to the village women; and d) each woman was asked to give verbal assent to participate, as many women in the tribe were unable to read or write in their native Dogon language or in the national language of Bambara. To meet the inclusion criteria, participants were required to self-identify as female and West African Dogon. Research assistants were trained and assisted by the principal investigator regarding all data collection methods. Study participants were compensated with USD$1 each as honorarium for their participation. As is the Dogon custom, women were allowed to keep the money they received for their participation. At the time of the study, USD$1 was equal to 500 West African, Central African Francs (CFA). According to the Mali government, anything more than USD$1 would have been considered excessive and coercive.

Measures

Demographic survey—Participants completed a demographic survey that obtained information regarding age, number of children, village affiliation, and any known family history of hypertension (age at diagnosis, medications and other treatments). The information was collected verbally from the participants and recorded by the investigator and research assistants. Parity was determined based on participant report of child delivery.

Blood pressure, height, and weight—Blood pressure (BP) was measured using a manual BP manometer with a size-appropriate upper arm cuff (model # A&D UA 767PC). Reported BP measurements represent an average of three seated BP readings. Procedures for participant preparation for BP measurement were in accordance with JNC-7 recommendations (sitting supine, with feet flat on the floor, taken in the same arm, etc.).[2]

Height was measured by a portable measuring tape. Weight was measured by a portable scale that was placed on a level surface and calibrated before use in each village (BWB/807 Tanita, Tokyo, Japan). Body mass index was calculated from height and weight measurements for each participant. Body mass index from 25 to 29 is considered overweight, with BMI equal to or greater than 30 indicative of obesity.[12]

Accuracy and consistency of the data obtained for blood pressure, height and weight were assured as all measurements were taken by the principal investigator and co-investigator (both doctorate-prepared registered nurse practitioners). All data were recorded by the same two research assistants and checked each day for accuracy. Additional information on recruitment methods are published elsewhere.[13]

Statistical Analysis

The data from the women were analyzed using PASW SPSS-W, ver. 17.0. Crosstabulations and descriptive statistics were used to provide a profile of the women. Pearson product moment correlations were used to determine the relationship between age and BMI and systolic and diastolic blood pressure. The comparison of age and BMI by presence or absence of a diagnosis of hypertension was tested using *t*-tests for independent samples. One-way analysis of variance (ANOVA) procedures were used to compare the systolic and diastolic blood pressure and BMI of the women by number of children, with *t*-tests for independent samples comparing the same variables by diagnosis of hypertension. All decisions on the statistical significance of the findings were made using an alpha level of . 05.

Results

A total of 133 women participated in this study (Table 1). Based on their average systolic and diastolic blood pressure readings, they were placed in two categories: hypertension group –women whose blood pressure readings were diagnostic of hypertension (systolic blood pressure [SBP] ≥ 140 mmHg or diastolic blood pressure [DBP] ≥ 90 mmHg) and normotensive group (SBP < 140 mmHg or DBP < 90 mmHg). The number of children ranged from 1 to 14. The number of children was divided into three categories (1–3, 4–5, and > 5). Of the women in the hypertension group ($n = 32$), 53.1% ($n = 17$) had more than 5 children, with 12.5% ($n = 4$) having from 1 to 3 children. The women were living in one of six Dogon villages, with 53 (40.5%) from Ogol-leye and 37 (28.2%) from Ogol-da. The women from these two villages had the highest number of blood pressure readings diagnostic of hypertension, ($n = 11$, 34.4% and $n = 12$, 37.4% respectively).

The average age of the women in the hypertensive group was 55.72 ($SD = 15.60$) years, with a range from 25 to 80 years. In comparison, women in the normotensive group had a mean age of 42.40 ($SD = 15.90$) years and a range from 19 to 83. When the two groups were compared the difference was statistically significant, $t(131) = 4.15$, $P < .001$. The SBP levels of women in the hypertensive group ranged from 128 to 177 mmHg, with a mean of 149.80 ($SD = 13.28$) mmHg. The women in the normotensive group had a mean SBP of 118.29 ($SD = 11.15$) mmHg, with a range from 93 to 139 mmHg. The mean DBP of women in the hypertensive group was 91.19 ($SD = 11.23$) mmHg, with a range from 65 to 121 mmHg. The range of DBP levels for women in the normotensive group was from 55 to 89 mmHg, with a mean of 76.93 ($SD = 7.77$) mmHg. Body mass index (BMI) ranged from 17 to 35 for women in the hypertensive group. These women had a mean BMI of 22.81 ($SD = 4.05$). In comparison, the mean BMI for women in the normotensive group was 22.15 ($SD = 2.87$), with a range from 16 to 30. The results of the *t* test comparing the two groups on BMI was not statistically significant, $t(131) = 1.02$, $P = .311$. (Table 2)

Statistically significant correlations were found between age and BMI ($r = -.25$, $P = .004$) and SBP($r = .45$, $P < .001$). Age was not related to DBP ($r = .14$, $P = .121$). While the correlation between BMI and SBP was not statistically significant ($r = 01$, $P = .976$), the correlation between BMI and DBP was statistically significant ($r = .18$, $P = .037$). (Table 3)

A series of one-way ANOVA procedures was used to determine if systolic and diastolic blood pressure and BMI differed among women relative to parity (Table 4). The results of the analysis demonstrated a statistically significant difference for SBP, $F(2, 130)$ 5 4.31, $P = .015$. To determine which of the three groups of children (1 to 3, 4 and 5, and more than 5) were contributing to the statistically significant result, Scheffé a posteriori tests were used. A statistically significant difference was found between women with 1 to 3 children ($M = 120.58$, $SD = 12.64$–mmHg) and those with more than 5 children ($M = 131.69$, $SD = 18.60$ mmHg). The women with 4 and 5 children ($M = 124.42$, $SD = 19.00$) did not differ from either of the other two groups. No statistically significant differences were found among the three groups for diastolic blood pressure or BMI.

The comparison of the number of children by diagnostic group (hypertensive or normotensive) was statistically significant, $t(131) = 3.41$, $P = .001$. (Table 5) Women who were in the hypertensive group tended to have a greater number of children ($M = 6.41$, $SD = 3.00$) than women in the normotensive group ($M = 4.71$, $SD = 2.25$).

Discussion

In this study, we investigated the influence of age and parity on blood pressure and BMI among rural West African Dogon women, replicating a similar investigation among urban African American women in a Midwestern urban area.[10] As there is evidence that urban African American women carry genetic markers linking their ancestry to Western Africa, we anticipated that this study of variables influencing hypertension in native Dogon women could advance our understanding of the environmental factors that contribute to genetic risk in the development of hypertension and obesity among Black women.

The Dogon women from the Ogol-leye and Ogol-da villages represented 68.7% of the total sample and together comprised the greatest percentage of women with hypertension (71.8%). The average age of women diagnosed with hypertension was 13 years greater than those who were not, consistent with the increase in blood pressure associated with advancing age.[13] The mean age, distribution, and range for Dogon women were remarkably similar to that reported among urban African American women. However, the incidence of hypertension was greater among the urban African American women (>50%) than among Dogon women (>33%). A significant correlation between age and SBP was consistent with heightened risk for hypertension with advancing age for both African American and Dogon women. Consistent with anthropometric findings among West African women reported elsewhere,[14,15] no significant differences were found in BMI among the Dogon women with and without hypertension. BMI was stable among Dogon women (with and without hypertension) and more than likely due to the scarcity of food resources and active physical lifestyle of the Dogon. However, as women aged, it appeared that increasing BMI contributed to additive risks for cardiovascular compromise. The relationship between age and BMI provided additional evidence to suggest increased cardiovascular risk, reinforced by the significant correlation between DBP and increasing BMI, even when BMI was in the normal range. In comparison, while there were no significant differences in BMI among the urban African American women based on diagnosis of hypertension, the average weight of women in both groups was in the obese range. The contrast of average BMI between West African and African American women suggested an environmental influence and likely contributed to the increased rate of hypertension seen in African American women. The

West African Dogon women had a dietary lifestyle of fresh organic foods, rich in vegetables, with little lean meat when available (chicken, lamb, and fish).[13] The Dogon women had daily physical activity in the form of gathering food from the fields, completing all of the household cleaning, and preparing all daily meals.[13] In contrast, African American women have access to fast food, use of motor vehicles and mass transit for purchase of food products, thereby limiting daily physical activity and fresh food intake.[13]

Mean differences in systolic and diastolic blood pressure values among Dogon women with and without hypertension were significantly different, as expected. While unrelated to BMI, significant differences in blood pressure were consistent with increasing parity. The lowest blood pressures were recorded among women with one to three children and highest among those with more than 5 children. The total number of children born to rural Dogon women with hypertension was significantly greater than those who were normotensive, providing evidence for the influence of parity on blood pressure regulation. When compared to African American women, the Dogon women in both hypertensive and normotensive groups had more children. However, parity continued to have a significant effect on blood pressure among African American women, with those women diagnosed with hypertension reporting an average of 4.26 children, compared to 3.25 children for those women in the normotensive group. These findings suggested a heightened risk for increased blood pressure consistent with increased parity.

The pattern in SBP in relation to parity was similar among African American women, though the differences were not statistically significant and no comparable differences in diastolic blood pressure were identified. In light of the high BMI reported among African American women, it is possible that the effect of parity was obscured by the influence of obesity on blood pressure regulation.

A potential explanation for the similarities of SBP trends in both rural Dogon and urban African American women may be related to a gene-environment interaction. In a previous study of rural Dogon women and urban African American women, the single nucleotide polymorphism (SNP) rs8179526 was significantly associated with SBP adjusted for both age and BMI.[13,16] This SNP, located on chromosome 2, has been linked to hypertension in African Americans as reported by multiple investigators.[17–20] The gene-environment interaction between the identified SNP and increased parity may contribute to elevated SBP and hypertension in these susceptible women.

Our study presents novel findings for the role of parity on the development of hypertension and obesity among rural Dogon women. The findings clearly demonstrate the influence of increased parity on elevations in blood pressure in an environment devoid of sedentary lifestyle and nutritional excess. These findings add to what is currently known about parity, obesity, and hypertension in African American women, and have the potential to substantially advance our understanding of variables contributing to hypertension. As cardiovascular disease is the leading cause of death in women, it is critically important to improve strategies for prevention and control of hypertension leading to improved public health.

Limitations of the Study

One limitation of this study was that Dogon women may have had hypertension, but had not been diagnosed or treated due to their environmental seclusion and inability to access health care. For those women who may have been diagnosed previously, age at hypertension diagnosis was not known. It is unknown whether the blood pressure readings diagnostic of hypertension existed before, during, or after any of the pregnancies. The timing of the hypertension development may have had an influence on the results of our study. However,

none of the women reported having had a history of preeclampsia, eclampsia, preeclampsia superimposed on hypertension, or HELLP syndrome during any of their pregnancies. Additionally, lifestyle factors (dietary sodium intake, physical activity, and alcohol intake), known to increase the risk for hypertension development, were not assessed in this study because of the natural control for these factors in this rural farming area. Another limitation of the study is the use of self-report demographic and natal history. The participants may have over-reported or under-reported their responses in an attempt to be socially acceptable. Although this type of bias is inherent in self-report measures, self-reporting is typically accepted in research as relatively accurate.

The study was also limited to rural West African Dogon women. The results cannot be generalized to women of other ethnic, cultural, or geographic backgrounds. Further longitudinal genetic studies of rural West African Dogon women following them from prenatal, throughout their pregnancies, and to the end of their childbearing years is needed before more definitive statements about the influence of parity on hypertension can be made. Larger samples of women, including representation from multiple ethnic and cultural groups in various geographic locations also is recommended to generalize the findings.

Conclusion

The findings of this study contribute evidence for the influence of age and parity on the development of obesity and hypertension, with direct relevance to the cardiovascular health of mothers and future generations of their children. As women approach their childbearing years, awareness of the association between number of children and factors such as age, body weight and blood pressure may be used to facilitate informed decisions regarding family size and optimization of health. Future longitudinal studies with women followed throughout the childbearing years are warranted to determine more precisely the long-term influence of age and parity on body weight and hypertension.

Acknowledgments

Funding for this research was provided in part by School of Nursing Dean’s Office and Office of the Vice Provost University of Michigan Ann Arbor, 5-P30-AGO15281-07 to Jacquelyn Taylor.

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Table 1

Crosstabulations – demographic characteristics of participants ($N = 133$)

	Diagnosed with Hypertension					
	Yes ($n = 32$)		No ($n = 101$)		Total	
Demographic Characteristics	***n***	**%**	***n***	**%**	***n***	**%**
Number of children						
1 to 3	4	12.5	31	30.7	35	26.3
4 and 5	11	34.4	42	41.6	53	39.8
More than 5	17	53.1	28	27.7	45	33.9
Name of village						
Inguele	2	6.3	4	4	6	4.6
Ogol-leye	11	34.4	42	42.4	53	40.5
Diamini-Goura	1	3.1	1	1	2	1.5
Bongo	3	9.4	19	19.2	22	16.8
Dini	3	9.4	8	8.1	11	8.4
Ogol-da	12	37.4	25	25.3	37	28.2

Table 2

Age, blood pressure readings, and body mass index by diagnosis of hypertension (*N*=133)

				Range			
	n	***M***	***SD***	**Min**	**Max**	***t***	***P***
Age							
Diagnosed	32	55.72	15.60	25	80	4.15	<.001
Not diagnosed	101	42.40	15.90	19	83		
Body Mass Index							
Diagnosed	32	22.81	4.05	17	35	1.02	.311
Not diagnosed	101	22.15	2.87	16	30		
Systolic Blood Pressure							
Diagnosed	32	149.80	13.28	128	177		
Not diagnosed	101	118.29	11.15	93	139		
Diastolic Blood Pressure							
Diagnosed	32	91.19	11.23	65	121		
Not diagnosed	101	76.93	7.77	55	89		

Table 3

Pearson Product Moment correlations of age and number of children with BMI, SBP, DBP

	Age			BMI		
	n	***r***	***P***	***n***	***r***	***P***
Body mass index	133	−.25	.004			
Systolic blood pressure	133	.45	<.001	133	.01	.976
Diastolic blood pressure	133	.14	.121	133	.18	.037

Table 4

One-way analysis of variance – blood pressure readings and BMI by number of children ($N = 133$)

					Range		
	N	***M***	***SD***	***Mdn***	**Minimum**	**Maximum**	***P***
Systolic Blood Pressure							
1 to 3	35	120.58[a]	12.64	118.00	101	153	.015
4 and 5	53	124.42[a]	19.00	120.67	93	177	
More than 5	45	131.69[a]	18.60	131.33	97	177	
Diastolic Blood Pressure							
1 to 3	35	78.30[a]	8.82	80.00	60	95	.376
4 and 5	53	80.67[a]	11.58	79.33	55	121	
More than 5	45	81.60[a]	10.70	82.00	62	104	
Body Mass Index							
1 to 3	35	22.72[a]	2.58	22.46	17	29	.059
4 and 5	53	21.51[a]	2.94	21.32	16	30	
More than 5	45	22.92[a]	3.72	22.31	17	35	

[a]Means in a cell sharing a subscript are significantly different.

Table 5

T tests for two independent samples: number of children by diagnosis of hypertension (*N* = 133)

	N	*M*	*SD*	*DF*	*t*	*P*
Diagnosed	32	6.41	3.00	131	3.41	.001
Not diagnosed	101	4.71	2.25			