Prevalence of Obesity and Associated Sex-Specific Factors in an African-Origin Population

Objective: To evaluate the prevalence of obesity and related sex-specific factors in a population of African descent.

Design: Population-based cohort study.

Setting and Participants: A simple random sample of 4,314 Barbados-born citizens of African origin, ≥40 years of age.

Main Outcome Measure: Obesity was defined as a body mass index (BMI: kg/m^2) ≥30.

Results: A significant sex differential for obesity exists in this population, with 11.5% of men and 33.2% of women found to have a BMI ≥30. Factors such as hypertension, elevated glycosylated hemoglobin and non-professional education were positively associated with obesity in both men and women, whereas an inverse relationship was found between obesity, current smoking, and older age. Among males, current drinkers were more likely to be obese (OR=1.43, 95% CI [1.04, 1.95]), whereas the reverse pattern was observed in the females (OR=0.59, [0.36, 0.98]). Other factors associated with obesity, specifically related to women, included lower socioeconomic status and increased parity.

Conclusions: The prevalence of obesity is high among Westernized women of African origin and cultural influences are thought to substantially contribute to this problem. Identifying sex-specific factors and providing culturally sensitive and tailored outreach services to those at highest risk may help to reduce the burden that obesity and its related comorbidities have placed on public healthcare systems worldwide. (*Ethn Dis*. 2007;17:508–514)

Key Words: Obesity, Body Mass Index, Risk Factors

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Introduction

The problem of obesity has reached epidemic proportions worldwide, with some of the highest rates affecting Westernized minority populations.[1] Additionally, sex differences have been noted in African Americans (AA) and other African-origin populations,[2–5] with significantly higher rates of obesity reported among women of African descent compared to men.[2–5] In the United States, data from the National Health and Nutrition Examination Survey (NHANES) III indicate a higher prevalence of obesity among AA women than men (38.2% and 21.1% , respectively),[2] with similar sex disparities reported in other populations of African origin.[3–7] The purpose of this investigation is to determine the prevalence of obesity in a large, population-based cohort study of African origin and investigate sex-specific factors associated with obesity in this population.

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Methods

The Barbados Eye Studies (BES) (1987–2003) were designed to determine the prevalence, incidence and risk factors for major eye diseases in the predominantly African origin population of Barbados, West Indies. The prevalence phase (BES: 1987–1992) included 4,631 persons (84% of those eligible) between 40 and 84 years of age. Of those, 4,314 (93%) self-reported their race as Black, 184 (4%) as mixed (Black and White) and 133 (3%) as White/other.

The BES protocol has been described in detail previously.[8] To summarize, the study examination included a complete ophthalmologic evaluation, a detailed interview, and anthropometric measurements. Height was assessed using a stadiometer; weight was determined using a balance beam scale. Demographic variables examined in this report included: age, sex, marital status, years of education and major type of occupation (professional [eg, managerial, technical] vs non-professional [eg, service, agricultural, homemaker]). Socioeconomic status (SES) was categorized as high, medium or low based on an index combining major lifetime occupation and years of education. Participants with >9 years of education and a professional lifetime occupation were classified as having high SES; those with ≤9 years of education and a non-professional lifetime occupation were defined as having low SES; others were defined as having medium SES. Other characteristics evaluated were: systolic and diastolic blood pressure (BP) (average of two random zero sphygmomanometer measurements), hypertension (systolic BP≥140 mm Hg or diastolic BP≥90 mm Hg or history of antihypertensive treatment), parity, smoking and alcohol use. Current smokers were defined as those smoking at least one cigarette, cigar or pipe daily during the past year. Current drinkers were those who reported consuming beer, wine or hard liquor at least once a month for the past year. Self-reported information on physician-diagnosed diabetes history and treatment was collected and venipuncture was performed to obtain levels of glycosylated hemoglobin (GHb). GHb measurements were available on 3,504 (81%) of the Black participants, as these data were not collected during the first few months of the study. Participants were classified into three groups according to GHb levels: low (≤7), medium (>7 and ≤10), and high (>10). Duplicate testing on a random sample (n=264) showed good reproducibility of GHb measurements, with an intraclass correlation coefficient=0.89. Body mass index (BMI) was calculated and obesity/overweight were defined using the World Health Organization (WHO) criteria, as follows: BMI<18.5 (underweight), 18.5–24.9 (normal), 25.0–29.9 (overweight), 30.0–34.9 (obese I), 35.0–39.9 (obese II), and ≥ 40.0 (obese III).

Statistical Analyses

Due to the small number of White/others in the study, the cross-sectional analyses presented in this report are based on Black participants only. Logistic regression models were used to evaluate potential associations between the prevalence of obesity and all of the factors described above. Analyses were performed independently for each sex, both on the full sample size and separately for the subset with available GHb data. Highly correlated variables such as GHb and diabetes history, education and occupation, and systolic blood pressure (SBP) and diastolic blood pressure (DBP) were entered in separate models, while adjusting for all other relevant factors. Odds ratios with 95% confidence intervals are presented.

Results

The median age of the 4,314 Black participants in BES was 58 years and 57% were female. In this population, the average BMI (mean±sd) in men and women was 25.2±4.2 and 28.2±5.8, respectively. Table 1 provides the distribution of BMI by sex and indicates that obesity was more common in females than in males, with 33.2% of women having a BMI≥30 compared to 11.5% of men. Likewise, a higher proportion of women than men had BMI≥40 (2.8% vs 0.5%, respectively). Overall, approximately 60% of the population was overweight (BMI≥25) and about one-fourth were obese (BMI≥30).

Table 1. Distribution of body mass index by sex based on WHO standards

	Male		Female		Total	
BMI*	*N*	%	*N*	%	*N*	%
<18.5	74	4.0	72	2.9	146	3.4
18.5–24.9	865	47.0	681	27.5	1546	35.8
25–29.9	690	37.5	900	36.4	1590	36.9
30–34.9	175	9.5	545	22.0	720	16.7
35–39.9	27	1.5	208	8.4	235	5.5
≥40	9	0.5	68	2.8	77	1.8
Total	1840	100.0	2474	100.0	4314	100.0

* BMI=Body Mass Index (kg/m^2)

Table 2 indicates that obesity rates generally increase in women until 60 years of age, followed by a steady decline in the older age groups. Among men, the prevalence of obesity decreased after 40–49 years of age. After adjusting for age, almost four times as many women as men were obese (OR=3.9, 95% CI [3.3, 4.6]) and more than twice as many women as men were overweight (OR=2.3, 95% CI [2.1, 2.7]).

As a result of the marked differences in prevalence rates of obesity among men and women, we performed separate analyses to determine the possible factors associated with obesity for each sex. Table 3 presents the logistic regression findings for the females. The model indicates that obesity was inversely associated with increasing age (OR=0.96, 95% CI [0.95, 0.97], per year of age) and higher SES. Separate models including occupation and education (in place of SES) supported the findings, indicating that non-professionals and those women with an education ≤12 years were more likely to be obese. Additional factors found to be positively associated with obesity included hypertension (OR=1.87, 95% CI [1.53, 2.27]), GHb and increased parity. An inverse relationship with obesity was found for both current smokers (OR=0.26, 95% CI [0.08, 0.90]) and current drinkers (OR=0.59, 95% CI [0.36, 0.98]).

Table 4 shows the results of the logistic regression analyses among the men. Similar to the women, older men and those who were current smokers were less likely to be obese, whereas a positive association was found among men with hypertension. However, in

Table 2. Age- and sex-specific prevalence of obesity

	Male (n=1840)		Female (n=2474)		Total (N=4314)	
Age, y	*n*	%	*n*	%	*N*	%
40–49	88	15.5	257	37.4	345	27.5
50–59	62	14.5	254	40.3	316	29.8
60–69	37	9.2	189	31.6	226	22.6
≥70	24	5.4	121	21.7	145	14.5
Total	211	11.5	821	33.2	1032	23.9

Table 3. Logistic regression model for associations with obesity in females (*n*=2474)

Factor	Obese‡ (*n*=821) %	Not Obese‡ (*n*=1653) %	OR	95% CI
Age, years (mean±SD)	56.7±10.9	60.0±12.2	0.96	(0.95, 0.97)
SES				
Low (vs high)	37.0	38.0	1.59	(1.09, 2.33)
Medium (vs high)	56.9	53.1	1.50	(1.04, 2.15)
Non-professional occupation*	81.9	77.0	1.30	(1.03, 1.64)
Education ≤12 years*	89.4	86.0	1.51	(1.13, 2.03)
Current smoker	0.5	1.4	0.26	(0.08, 0.90)
Current drinker	2.8	4.6	0.59	(0.36, 0.98)
Hypertension	65.2	56.8	1.87	(1.53, 2.27)
Systolic BP≥140*	43.0	44.2	1.20	(0.99, 1.46)
Diastolic BP≥90*	26.1	20.1	1.41	(1.15, 1.73)
Diabetes history	18.9	16.8	1.16	(0.92, 1.46)
GHb level†				
Medium (vs low)	48.2	41.6	1.60	(1.29, 1.98)
High (vs low)	16.1	12.3	2.01	(1.37, 2.93)
Parity				
No children	10.7	15.9	1.0	
1–2 children	21.2	26.7	1.03	(0.76, 1.41)
3–4 children	25.2	23.4	1.34	(0.98, 1.82)
5–6 children	21.3	17.4	1.56	(1.13, 2.16)
7+ children	21.7	16.7	1.77	(1.28, 2.45)

* Entered in separate models, while adjusting for all other variables
† GHb=glycosylated hemoglobin; based on 1,989 females with available data
‡ Obese=BMI≥30; Not obese=BMI<30

Table 4. Logistic regression model for associations with obesity in males (*n*=1840)

Factor	Obese‡ (*n*=211) %	Not Obese‡ (*n*=1629) %	OR	95% CI
Age, years (mean±SD)	54.5±10.6	59.3±12.4	0.96	(0.95, 0.97)
SES				
Low (vs high)	24.2	31.6	1.15	(0.74, 1.78)
Medium (vs high)	53.1	44.2	1.38	(0.96, 2.00)
Non-professional occupation*	60.0	54.4	1.39	(1.03, 1.88)
Education ≤12 years*	82.9	81.4	1.45	(0.97, 2.15)
Current smoker	8.5	15.8	0.44	(0.26, 0.74)
Current drinker	37.9	31.7	1.43	(1.04, 1.95)
Hypertension	55.0	49.0	1.46	(1.07, 1.99)
Systolic BP≥140*	36.0	37.0	1.23	(0.89, 1.71)
Diastolic BP≥90*	29.9	22.3	1.63	(1.17, 2.26)
Diabetes history	19.9	11.8	2.05	(1.38, 3.05)
GHb level†				
Medium (vs low)	50.3	38.3	2.16	(1.51, 3.08)
High (vs low)	14.1	7.0	2.89	(1.53, 5.47)

* Entered in separate models, while adjusting for all other variables
† GHb=glycosylated hemoglobin; based on 1,515 males with available data
‡ Obese=BMI≥30; Not obese=BMI<30

contrast to the women, a positive association between obesity and current drinking was noted (OR=1.43, 95% CI [1.04, 1.95]). The point estimate for medium SES was modest (OR=1.38), yet did not reach statistical significance. In separate models, non-professional occupation was shown to be associated with obesity (OR=1.39, 95% CI [1.03, 1.88]), whereas the relationship with education was not statistically significant. Additionally, a history of diabetes (based on self-reported information only) was associated with obesity in the men (OR=2.05, 95% CI [1.38, 3.05]) but not in the women. GHb was also significantly related to obesity in men.

DISCUSSION

The purpose of the present investigation was to evaluate the prevalence and possible factors associated with obesity in a large, population-based cohort of predominantly African-origin. The prevalence of obesity in adult African Barbadian (AB) women was found to be high (33.2%), whereas obesity among AB males was significantly lower (11.5%) than in other groups. This finding was consistent with other reports in the AB population.[4,5] Table 5 presents corresponding sex-specific rates of obesity among populations of African origin from West Africa, the Caribbean and the United States. Obesity rates among AA males are similar to those of their European counterparts, whereas rates among AA females are 1.5 times higher than in women of European origin.[2] Interestingly, obesity rates among women in the Caribbean parallel those among AAs, whereas rates among Afro-Caribbean men are less than half of those in AA men. The prevalence of obesity is lower among West African nations compared to the more Westernized countries, with rural areas in West Africa found to have a lower prevalence of overweight individuals than urban communities. None-

Table 5. Prevalence of obesity among populations of African origin

	Year	Age, years	Obesity* Defined	% Obese			
				Male		Female	
				n	%	*n*	%
West Africa							
Cameroon (Rural)[3]	1993	25–74	BMI≥31.1, M; BMI≥32.3, F	745	1.6	722	4.5
Cameroon (Urban)[3]	1993	25–74	BMI≥31.1, M; BMI≥32.3, F	614	6.4	749	13.0
Nigeria (Urban)[3]	1993	25–74	BMI≥31.1, M; BMI≥32.3, F	510	2.8	658	5.4
Caribbean							
Barbados[4]	1993	40–79	BMI≥30	190	10.0	274	30.0
Barbados[5]	1999	60+	BMI≥30	583	11.9	925	31.0
Jamaica[34]	1999	30+	BMI≥30	621	9.2	546	30.8
Jamaica[35]	1993	25–74	BMI≥31.1, M; BMI≥32.3, F	340	5.9	480	19.6
St. Lucia[35]	1993	25–74	BMI≥31.1, M; BMI≥32.3, F	491	4.7	598	17.6
US							
NHANES (Non-Hispanic Black)[9]	1988–1994	20+	BMI≥30	2112	21.1	2490	38.2
NHIS (Non-Hispanic Black)[7]	1998	45+	BMI≥30	3558	24.7	4767	34.4

* BMI =body mass index

theless, the sex disparities are still apparent. Factors found to influence rates of obesity in the BES are described below.

Age

The prevalence of obesity has been shown to be age-dependent, with a "U" or "J" shaped distribution characterizing the pattern. Data from both NHANES III and the Behavioral Risk Factor Surveillance System show an increase in obesity until age 60 years, with a steady and subsequent decrease in the older age groups.[9,10] Findings from the present investigation are consistent with these results (Table 2).

SES/Education/Occupation

Data from the BES indicate that sex differences may exist for SES and obesity, with lower SES being a significant factor related to obesity in women but not so clearly in men. This result is consistent with others[5,11,12] and may be related to an increased likelihood among women at higher levels of SES to be concerned about weight and diet, with less social pressure among the men to maintain a thinner body image.[12] It should also be noted that dietary associations with SES are likely to influence obesity risk, as those with lower SES have been shown to consume a higher proportion of energy dense, nutritionally poor foods.[13]

Taken independently, years of education have been generally shown to be inversely associated with obesity in national data,[7,14] whereas the relationship between low-status occupations and obesity has been inconsistent.[15–18] The lack of consistent findings in the latter is not surprising, given the large number of variables possibly related to occupation and likely influencing the outcome measure. These factors include (but are not limited to): amount of leisure time physical activity, diet and lifestyle variables, and a broad range of job classifications with varying occupational activity levels. It is often quite difficult to disentangle the inter-relationships between these variables. For example, some non-professional occupations require more manual labor, especially for men, thus resulting in an inverse association with obesity,[17,18] whereas these jobs, by their nature, may limit the opportunity for physical leisure time activity and healthy eating choices, thus contributing to the obesity problem. Findings from the present study indicate that non-professional occupations and fewer years of education are associated with obesity in women, whereas occupation, but not education, is a factor among the men. In Barbados, 21% of the women are homemakers (as opposed to none of the men). Being at home, either as a homemaker, retiree or unemployed person has been shown to contribute to obesity.[16,17] In the BES, those with occupations centered mostly outdoors were significantly less likely to be obese than individuals with indoor occupations ($P<.01$), as expected. This finding supports the hypothesis that occupational physical activity is inversely related to obesity and supports the theory that low activity, non-professional employees are more likely to be obese. This may be due to the fact that non-professionals employed in low activity occupations (such as some service jobs and production workers) are often required to work long hours on a daily basis, thus providing limited opportunities for leisure time physical activities. Additionally, these individuals are less likely than their professional counterparts to be able to afford more wholesome food options due to their lower salaries and the higher cost of healthier commodities.

Parity

Several studies have reported that childbearing is an important contributor to weight gain.[19–21] Bastian et al[19] reported a dose-response relationship between the number of children and obesity among older women. In that study, women with three or more live births were significantly more likely to be obese, and the risk of obesity increased 11% with each additional live birth. Results from the present analysis support these findings. It has been proposed that the association of number of children and obesity among women may be related to insulin resistance as a result of altered glucose metabolism during pregnancy.[22,23] This may help to explain the sex differences in obesity in highly parous African-origin populations.

Diabetes/Hypertension

It has been well-established that obesity is associated with hypertension, diabetes, coronary heart disease, stroke and other complications.[4,24–28] Findings from a small study in Barbados (n=190 men, 275 women) indicated that obese subjects were 2.6 times more likely to have hypertension and 2.5 times more likely to have diabetes than persons with a BMI <25.[4] Although the relationship between obesity and hypertension in that study did not achieve statistical significance in men, the magnitude of the result was substantial and a possible association can not be discounted (OR=2.7, 95% CI [0.9, 8.1]). The association between obesity and hypertension among women was clearly evident, however (OR=3.3, 95% CI [1.6, 6.6]). With respect to diabetes, obese men demonstrated relatively no association (OR=1.0, 95% [0.3, 4.1]), whereas a strong positive relationship was found in the women (OR=5.2, 95% CI [1.9, 14]). It was unclear from that study whether the results reported for the men were a consequence of inadequate sample size or a true finding. The present study included 9 times as many AB participants and found positive associations between obesity and both hypertension and GHb level in men and women.

Smoking Use

Smoking has typically been inversely correlated with increased weight in both women and men.[12,29,30] Findings from NHANES II showed that former smokers were heavier than current smokers and that the mean body weight of smokers was less than those who never smoked.[29] National estimates indicate that approximately 35–45% of men smoke, whereas 30–35% of women are current tobacco users.[12,29] In Barbados, the percentages are much lower, with only 15% of the men and 1% of the women identified as current smokers. Despite these small numbers, results from the present study support the negative association between smoking and obesity in both men and women (Tables 3 and 4). Since both AA and AB men are generally leaner than the women and a significantly higher portion of these men smoke, it appears as though tobacco use may be a contributing factor, at least in part, to the sex differences in obesity in these Westernized populations of African descent.

Alcohol Consumption

Reports describing the relationship between the consumption of alcohol and obesity have indicated that the influence of alcohol on body size appears to be different for men and women.[12,29,31] The present investigation supports an inverse relationship between alcohol use and obesity in women but found that among men, drinking was positively associated with obesity. This notable sex differential may be directly related to the amount of alcohol consumed. Men who reported drinking averaged 3–4 beers or 6 ounces of hard liquor approximately 3–4 times per week, whereas women drinkers averaged 1–2 beers or 3 ounces of hard liquor about 1–3 times per week. Another explanation is that calories from alcohol may account for a larger proportion of total caloric intake in the women, thus serving to protect against weight gain. One must also consider that drinking habits in this population are dictated to some degree by the culture, in which it is socially acceptable for men to drink and less encouraged for the women. Of final note, since drinking is uncommon in AB women, one cannot discount the possibility of unrecognized confounding with other social and medical variables, which may also contribute to the observed sex differential.

Rates of obesity in non-Hispanic men and women of European origin have been found to be comparable,[2,9,32,33] whereas rates among women of African origin are substantially higher than in their male counterparts.[2,4,9,32-35] Likewise, data from the BES showed obesity rates approximately 3 times higher in AB women than men. Why does such a sex differential for obesity exist? The reason(s) may be attributable, at least in part, to cultural issues.

For example, the disparity in tobacco use between the sexes may contribute to the differential in weight gain between men and women. Another contributor to the sex differential in obesity may be that more than 60% of the women in the cohort gave birth to 3 or more children. Since increases in parity have been shown to be positively associated with weight gain, this sociocultural practice might help to explain the high obesity rates in AB women, as well as the differential in BMI between AB men and women.

Limitations

Although the present investigation has numerous strengths, including the large, population-based cohort with high participation, the use of standardized protocols, and the clinically ascertained anthropometric, as well as other measurements, the analyses were cross-

In both African Barbadian males and females, hypertension, elevated GHb level and non-professional occupation were factors found to be positively associated with obesity…

sectional and the study was limited by the lack of data on leisure-time physical activity and diet, both of which are thought to influence obesity and contribute to the sex differential. Additionally, the data relating to alcohol intake and tobacco use were not exhaustive and limited our ability to better quantify these factors. Lastly, GHb measurements were not collected at the beginning of the study for approximately 19% of the cohort. We do not believe, however, that these additional GHb data would significantly alter the results.

CONCLUSIONS

The prevalence of obesity among Westernized populations of African origin is high and the rates in Barbados, West Indies are no exception. In both AB males and females, hypertension, elevated GHb level and non-professional occupation were factors found to be positively associated with obesity, whereas current smokers and those in the older age groups tended to be leaner. Among AB men, current drinkers were more likely to be obese, whereas an inverse association was found between current drinking and obesity in AB women. Other factors related to obesity specific to women included higher parity and possibly lower SES. Educating this population and others of African origin about their specific risk factors for obesity, and providing culturally sensitive prevention and treatment programs, may help to reduce obesity rates and diminish the public health burden associated with this growing epidemic.

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APPENDIX

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