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# PHYSICAL ACTIVITY REDUCES BREAST CANCER RISK IN AFRICAN AMERICAN WOMEN

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## Abstract

**Objective—**To examine the relationship between physical activity and breast cancer in African American women.

**Design—**A population-based case-control study was conducted with 199 women (97 cases and 102 controls) from the Washington, DC metro area. A self-report physical activity questionnaire elicited responses on walking for exercise and vigorous physical activity (e.g., running, aerobics, etc.) in the past year. Responses were used to calculate a metabolic equivalent (MET) score [*MET-hours/week = hours/week vigorous activity×7+ hours/week walking ×3*]. The MET score was categorized into low, medium and high tertiles. Multivariate logistic regression examined the association between physical activity and breast cancer.

**Results—**African American women who engaged in vigorous physical activity (> 2 hours/week in the past year) had a 64% reduced risk of breast cancer compared to those who did not participate in any vigorous activity (odds ratio, OR = 0.36; 95% confidence interval, CI = 0.17–0.75). We also found a 64% reduced breast cancer risk in women with a high versus low tertile of total activity (OR = 0.36; 95% CI = 0.16–0.79). For postmenopausal women, vigorous physical activity and total activity (high versus low tertile) also had an inverse relationship with breast cancer ($p<.05$).

**Conclusion—**Data regarding the association of physical activity and breast cancer has been equivocal and lacking for African American women. This study found that modest levels of physical activity reduced breast cancer risk in this group. Targeted efforts are needed to encourage more African American women to engage in physical activity.

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**Keywords**

Total activity; blacks; postmenopausal; women

## INTRODUCTION

Breast cancer is the leading cancer diagnosed in US women. With more than 190,000 cases diagnosed each year, there are few prevention strategies.[1] Known risk factors, such as genetic mutations and family history of cancer, account for only 30% of a woman's risk for being diagnosed with breast cancer.[1] Thus, lifestyle changes may reduce a woman's breast cancer risk. Research suggests that an increase in physical activity, in particular, among sedentary, post-menopausal women changes their hormone levels to reflect a lower risk of breast cancer diagnosis.[2] Therefore, physical activity may be one of the best approaches towards the primary prevention of breast cancer.[2–4]

The relationship between physical activity and breast risk is complex and may be explained by certain molecular mechanisms. It is plausible that physical activity could affect breast cancer risk because it also affects other risk factors, such as menstrual cycle, body mass, immune system, and hormones such as IGF.[3–6] It is well accepted that physical inactivity increases one's risk of obesity. Obesity has separately been considered a breast cancer risk factor and there is an inverse relationship between obesity and physical activity.[7] How physical activity and obesity might confound each other is unknown; obesity is positively associated with breast cancer risk in postmenopausal women but inversely associated with risk in premenopausal women.[8] Further, some data suggests that adult weight gain, rather than BMI, affects breast cancer risk, especially among non users of hormonal replacement therapy.[9]

Studies have shown a relationship between obesity and risk of breast cancer but in samples of mostly Caucasian women.[10, 11] Research, although equivocal, suggest that physical activity is inversely related to breast cancer risk in both pre- and postmenopausal women.[2] Considering African American women have higher rates of being overweight or obese, limited physical activity may be a significant breast cancer risk factor in this population. Some data in African American women suggests that breast cancer risk is reduced with increased physical activity.[4] In a study by Adams-Campbell et al[3], strenuous physical activity was associated with a reduced risk of breast cancer in African American women. This study, however, focused only on strenuous physical activity levels. Bernstein et al[4] also found that increased physical activity reduces breast cancer risk in African-American women. However, this study also lacked data on the effect of moderate intensity exercise in this population. More research is needed to determine whether moderate levels of physical activity can also reduce breast cancer risk in this population.

African Americans compared to Caucasians are more overweight, obese, and have higher BMI and waist-to-hip ratios.[12, 13] Further, over 50% of African American women aged 40 years or older are obese and more than 80% were overweight.[14] Coupled with the tremendous breast cancer burden among African-American women, physical activity has been targeted because it is a suspected mutable risk factor. The present study assessed the link between physical activity and breast cancer among African-Americans.

## METHODS

A case-control design was employed to identify the impact of physical activity on breast cancer risk. Study approval was obtained from Institutional Review Boards at Georgetown University Medical Center, Washington, DC and Howard University, Washington, DC.

**Cases—**All cases recruited in this study were African American women born in the U.S., residing in the Washington, D.C. metro area and diagnosed with breast cancer at the Howard University Hospital, Washington, DC within 6 months prior to the interview. Eligible women had a working home telephone and were able to communicate in English. Severely ill or institutionalized women were excluded from the study. Also ineligible women were those suffering from drug abuse or unable to give informed consent. After the initial identification of the cases from the surgical schedules, and the confirmation of diagnosis via pathology reports, consent was obtained from the surgeon to contact subjects. Patients were contacted by a formal invitation letter and follow-up telephone call to discuss the willingness to participate in the study, confirm eligibility, and schedule an interview; 70% participated. The final sample included 97 cases (unilateral or bilateral).

**Controls—**Population controls were randomly selected from Washington, a D.C. Voters Registration List obtained from the D.C. Board of Election. The controls were contacted by an invitation letter followed by telephone calls to discuss the study and willingness to participate. Upon receiving verbal consent an interview was scheduled. On the day of the interview participants read and signed consent forms and completed the same survey as cases after which a blood sample was drawn. Eligibility criteria were the same as those for cases except that the controls must have had no personal history of breast cancer. Approximately 52% (115/221) of the controls were successfully contacted and enrolled in the study, 48 percent (n=106) completed at least a portion of the study and 46% (102/221) completed the entire study.

### Data Collection

Trained interviewers administered a structured questionnaire that included demographic, physical activity, weight, height, menopausal status, family history of breast cancer, age at menarche, age at first full-term birth, education and income. Anthropometric measurements were taken and a blood sample was drawn. The physical activity data assessed were the responses to questions on a questionnaire about how many hours per week the participants spent on vigorous physical activity (e.g., basketball, swimming, running, and aerobics) during the past year. The response categories were: None, <1, 1, 2, 3–4, 5–6, 7–9, 10+ hours per week. Participants were also asked how much time they spent per day during the past year walking for exercise. The responses were also given as none, <1, 1, 2, 3–4, 5–6, 7–9, 10+ hours per day. These categories were further reduced to none, ≤ 2, and > 2 hours per week (per day) for vigorous physical activity and walking for exercise. To investigate total time spent in vigorous physical activity and walking for exercise, a MET (metabolic equivalent) score was used and calculated as [*MET-hours/week = hours/week vigorous activity×7+ hours/week walking ×3*]. The MET score was then categorized into low, medium and high tertiles.

## STATISTICS

Differences between cases and controls on continuous and categorical variables were tested by Student's t-test and Pearson's $\chi^2$ test. Unconditional multivariate logistic regression models were used to compute odds ratios (ORs) and the corresponding 95% confidence intervals (CIs). For the model where total activity was the exposure of interest, we adjusted

for age (continuous), menopausal status, BMI (continuous), family history of breast cancer (yes/no), age at menarche (≤ 12, >12), age at 1st full-term birth (nulliparity, <20, 20–24, 25+), education (less than high school, high school or above), and income (< $30,000, ≥ $30,000 annually). Additionally, we adjusted for walking for exercise (vigorous activity) whenever vigorous activity (walking for exercise) was the exposure of interest. Analyses were done separately for premenopausal and postmenopausal women. Analysis was conducted using SAS software, release 9.1; the significance level was set at 0.05.

## RESULTS

As shown in Table 1, cases were significantly older than controls (t-test, p-value = 0.002) and a higher proportion were married ($\chi^2$-test, p-value =0.003). Compared with controls, cases had higher BMI (32.02±6.85 versus 31.34±6.77 kg/m$^2$), completed more years of formal education (89.7% versus 85.3% high school or above), earned more income (over 59% versus 54% earned $30,000 or more) and had a higher proportion of relatives with breast cancer. For these variables, however, tests for associations with breast cancer status were not significant.

Logistic regression results revealed that vigorous physical activity of more than two hours per week was significantly associated with a 64% decrease in the risk of breast cancer. There was also evidence that greater hours of vigorous physical activity was associated with larger reductions in the risk of breast cancer (p-value for trend <0.01). On combining walking for exercise and vigorous physical activity to create MET-hours/week score, there was evidence that participants in the medium and high tertiles had, respectively, 17% and 64% reduced breast cancer risk compared with those in the low tertile. Breast cancer risk was further assessed separately by menopausal status. Compared with sedentary women, postmenopausal women who participated in vigorous physical activity for > 2 hrs/wk had an adjusted OR of 0.38 (95% CI= 0.14–0.99). There was evidence of a non-significant association between vigorous physical activity and breast cancer risk for premenopausal women for all levels of activity versus no activity. For total activity both premenopausal and postmenopausal women in the high tertile (compared with low tertile) had a reduced breast cancer risk with (OR = 0.11, 95% CI = 0.01–0.74 and OR = 0.33, 95% CI = 0.12–0.88, respectively).

## DISCUSSION

We found that vigorous activity levels of 2 hours/week was protective of breast cancer among postmenopausal women and high levels of total activity (≥ 40.25 MET-hours/week) were protective of breast cancer for both pre- and postmenopausal women. To our knowledge, only three published studies have addressed this issue in African-Americans.[15] Adams-Campbell et al[3], found high levels of strenuous physical activity during early adult years were associated with reduced relative odds of breast cancer. Recently, Bernstein et al[4] examined lifetime recreational exercise activity and breast cancer risk among black and white women and observed a modest decreasing breast cancer risk associated with increasing physical activity levels averaged over a woman's lifetime. Our findings support the association between physical activity and breast cancer risk among African-American women. Data reveal that even modest levels of physical activity can reduce breast cancer risk for premenopausal and postmenopausal women. More importantly, the protective effect of physical activity among African-Americans was independent of body mass.[15, 16]

The mechanisms through which physical activity may influence breast cancer development have not been fully elucidated, although several plausible biological mechanisms have been proposed. Because the effect is independent of age and BMI, there is likely a direct

influence of physical activity on biological mechanisms.[17] The positive association in pre- and postmenopausal women of physical activity and breast cancer risk as well as the inverse association of obesity and premenopausal breast cancer diagnosis[5] suggests a direct biological effect. These mechanisms may include changes in endogenous sex hormones, metabolic hormones, growth factors, central adiposity and immune functioning.[17] Endogenous estrogens are known to increase risk of breast cancer in both pre-menopausal and post-menopausal women.[18] Physical activity may affect the risk of endogenous estrogens by reducing production as well as increasing the amounts of sex-hormone binding globulin, which binds to endogenous estrogen and reduces its ability to influence target tissues.[18] Reduced circulating estrogens are reported with increased physical activity in postmenopausal women.[19,20] Regular physical activity also lowers insulin levels which confer decreased cancer risk.[21] Additionally, physical activity reduces cancer risk by affecting IGFs.[12, 22]

Weight control, another important factor, may mediate the effects of physical activity on a woman's breast cancer risk. In fact, the International Agency for Research on Cancer estimates that between one fourth and one third of cancer cases are attributed to the combined influence of elevated body weight and inadequate physical activity. Weight distribution, particularly abdominal fat may contribute to greater risk.[23]

Immune functioning, another biological mechanism, may influence breast cancer risk. Data suggest that blood immune function is positively associated with progression-free and overall survival.[24] Exercise may enhance blood immune functioning by improving natural killer (NK) cell cytotoxic activity, monocyte function, and the proportion of circulating granulocytes.[14, 17] While several hypotheses are proposed to explain the pathways between physical activity and breast cancer, more research is necessary to refine our scientific knowledge.

A strength of this study is the focus on an understudied population. We also include newly diagnosed incident cases versus prevalent cases which reduces recall bias since the lag time from diagnosis to participating in the study is short. Potential limitations are selection bias and that causation cannot be determined.

Given the limited information regarding mutable risk factors for breast cancer, this study adds to the growing evidence that supports a link between physical activity and breast cancer. African American women have higher rates of obesity compared to ethnic groups but only 36% are estimated to participate in vigorous physical activity.[25] Given the public health significance of this modifiable risk factor, interventions that engage African American women are necessary.

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## Table 1

Distribution of study characteristics by breast cancer status

| Variables | Cases (n=97) n (%) | Controls (n=102) n (%) | p* |
|---|---|---|---|
| Age, years | 57.63 ± 13.22 | 52.42 ± 9.93 | .002 |
| BMI, kg/m2 | | | .213 |
| <25 | 10 (10.3) | 18 (17.8) | |
| 25–29 | 34 (35.1) | 27 (26.7) | |
| ≥30 | 53 (54.6) | 56 (55.5) | |
| Waist-to-hip ratio | | | .253 |
| <.80 | 13 (14.0) | 17 (17.9) | |
| .80–.99 | 78 (83.9) | 72 (75.8) | |
| ≥1.00 | 2 (2.2) | 6 (6.3) | |
| Education level | | | .350 |
| <High school | 10 (10.3) | 15 (14.7) | |
| ≥ High school | 87 (89.7) | 87 (85.3) | |
| Marital status | | | .003 |
| Single/never married | 14 (14.4) | 32 (31.4) | |
| Married | 41 (42.3) | 23 (22.5) | |
| Divorced, separated or widowed | 42 (43.3) | 47 (46.1) | |
| Income | | | .434 |
| <$30,000 | 38 (40.4) | 46 (46.0) | |
| ≥ $30,000 | 56 (59.6) | 54 (54.0) | |
| Age at menarche (yrs) | | | .616 |
| ≤12 | 46 (47.4) | 52 (51.0) | |
| >12 | 51 (52.6) | 50 (49.0) | |
| Age at 1st full-term birth (yrs) | | | .289 |
| No births | 10 (10.3) | 15 (14.7) | |
| <20 | 40 (41.2) | 50 (49.0) | |
| 20–24 | 23 (23.7) | 15 (14.7) | |
| ≥25 | 24 (24.7) | 22 (21.6) | |
| Family history of breast cancer | | | .287 |
| No | 68 (70.8) | 79 (77.5) | |
| Yes | 28 (29.2) | 23 (22.5) | |
| Menopausal status | | | .084 |
| Premenopausal | 20 (20.6) | 32 (31.4) | |
| Postmenopausal | 77 (79.4) | 70 (68.6) | |
| Smoking history | | | .083 |
| Never | 62 (63.9) | 54 (52.9) | |
| Current | 8 (8.2) | 19 (18.6) | |
| Former | 27 (27.8) | 29 (28.4) | |

| Variables | Cases (n=97) n (%) | Controls (n=102) n (%) | P* |
|---|---|---|---|
| Alcohol history | | | .093 |
| Never | 67 (69.1) | 56 (54.9) | |
| Current | 15 (15.5) | 27 (26.5) | |
| Former | 15 (15.5) | 19 (18.6) | |
| Walking for exercise, hrs/day | | | .751 |
| None | 26 (26.8) | 24 (23.5) | |
| <2 | 52 (53.6) | 54 (52.9) | |
| >2 | 19 (19.6) | 24 (23.5) | |
| Vigorous physical activity, hrs/wk | | | .010 |
| None | 59 (60.8) | 40 (39.2) | |
| >2 | 12 (12.4) | 19 (18.6) | |
| ≤2 | 26 (26.8) | 43 (42.2) | |
| Total activity (tertiles) | | | .018 |
| <15.75 | 36 (37.1) | 27 (26.5) | |
| 15.75–40.24 | 35 (36.1) | 28 (27.5) | |
| ≥40.25 | 26 (26.8) | 47 (46.1) | |

Age is presented as mean ± SD.

*P (two-sided) were from t test (for continuous variables) and $x^2$ test (for categorical variables).