

Introduction

Many studies have shown that physical activity is associated with reduced risk of breast cancer. However there are inconsistencies in many areas that need to be resolved (Sprague et al., 2007). Areas of particular interest include further analyses of effect modification by race, menopausal status and cancer characteristics such as receptor status and node involvement.

The present study examines the relationship between recreational physical activity and breast cancer risk in a population based case-control study.

Study Aim

To examine the association between exercise and risk breast cancer.

Methods

Overview of the Study

The Global Epidemiology Study: The Global Epidemiology Study (GES) is a multinational study to assess disease risk factors. Subjects were recruited to the GES from countries including the United States, Tunisia and Poland. The GES is linked to the Global Repository that houses biomaterial. For breast cancer, newly diagnosed subjects provided informed consent and were asked about exercise activity during in-person interviews using the same survey instrument.

Participants: We examined the association between exercise and breast cancer risk among 1462 breast cancer cases and 4863 cancer-free controls in the Global Epidemiology Study (GES).

Design of Current Project

Participants: 1462 breast cancer cases and 4863 controls (total=6325)

- Inclusion criteria:
- Physical activity data available
 - Race of Caucasian-Americans, African-Americans, Hispanic-Americans, Tunisian-Arabs, and Polish-Caucasians (Asians were excluded due to unavailability of controls)

Covariate data: Data from the baseline questionnaire and medical assessment included data on age, race, diet, physical activity, cancer family history, cancer histology, cancer stage, tumor receptor status and lymph node involvement.

Statistical Analyses:

- Cross tabulations with Chi square tests and t-tests were conducted to determine the association between cancer status and potential confounders.
- Unconditional logistic regression was used to compute odds ratios (ORs) and 95% confidence intervals (CIs). The variables used in the multivariate analyses were age, pack-years of smoking and BMI as continuous variables and race as a categorical variable.
- Potential confounding of the association between exercise and cancer risk was explored using Spearman rank correlation analyses and multivariate logistic regression models, including stepwise regression models. If the potential confounder caused a >20% change in the β coefficient, it was kept in the model for further analyses.
- All p-values shown are 2-sided.
- All statistical analyses were performed using the software package STATA (STATA Corporation, College Station, TX).

Results

Table 1. Crosstabs of Demographics and Health Behavior Indicators

Characteristic	All Controls (N=4862)	All Cases (N=1463)	P-Value	Caucasian American Controls (N=2406)	Caucasian American Cases (N=973)	P-Value	African American Controls (N=406)	African American Cases (N=88)	P-Value
Age (Years)*	53.5	59.3	<0.0001	56.6 [13.1]	61.08 [13.4]	<0.0001	45.6 [12.2]	56.3 [13.3]	<0.0001
Smoking									
No	3240 [66.6%]	874 [59.9%]		1434 [59.6%]	520 [53.5%]		176 [43.4%]	47 [53.4%]	
Yes	1624 [33.4%]	586 [40.1%]	<0.0001	974 [40.4%]	452 [46.5%]	<0.001	230 [56.7%]	41 [46.6%]	ns
Smoking pack years*	5.4 [12.7]	7.8 [15.8]	<0.0001	18.5 [19.7]	21.5 [21.2]	<0.01	10.9 [12.2]	15.4 [13.6]	<0.04
Vegetables (Servs/day)*	2.0 [1.2]	2.1 [1.2]	<0.03	2.2 [1.3]	2.3 [1.2]	ns	2.3 [1.3]	1.7 [1.0]	<0.0001
Fruits (Servs/day)*	1.8 [1.1]	1.9 [1.1]	ns	1.9 [1.2]	2.0 [1.2]	<0.02	2.0 [1.5]	1.6 [1.3]	<0.05
Red meat (Times/week)*	2.7 [1.9]	2.6 [1.8]	ns	2.6 [1.9]	2.5 [1.8]	ns	3.3 [3.0]	2.5 [1.9]	<0.005
BMI, Kg/m ² *	27.5 [6.0]	27.8 [6.1]	<0.03	27.3 [5.9]	27.7 [6.4]	ns	31.0 [7.9]	30.4 [6.9]	ns
Exercise (Times/week)*	3.0 [2.6]	2.4 [2.7]	<0.0001	3.3 [2.6]	2.6 [2.6]	<0.0001	3.6 [2.7]	2.0 [2.6]	<0.0001
Exercise (Mins/time)*	33.8 [45.1]	27.5 [46.9]	<0.0001	36.0 [44.0]	26.4 [44.6]	<0.0001	38.4 [52.9]	17.1 [24.5]	<0.0003
Exercise (Mins/week)*	154.1 [256.8]	129.3 [260.1]	<0.001	161.6 [246.9]	116.4 [214.7]	<0.0001	187.3 [297.8]	82.0 [155.6]	<0.0016
Characteristic	Hispanic American Controls (N=1088)	Hispanic American Cases (N=58)	P-Value	Tunisian Arab Controls (N=266)	Tunisian Arab Cases (N=97)	P-Value	Polish Caucasian Controls (N=696)	Polish Caucasian Cases (N=247)	P-Value
Age (Years)*	50.1 [15.7]	60.7 [15.3]	<0.0001	43.4 [9.1]	51.4 [10.8]	<0.0000	56.3 [6.5]	56.3 [11.0]	ns
Smoking									
No	892 [81.9%]	44 [77.2%]		260 [98.1%]	95 [99.0%]		478 [68.7%]	168 [68.0%]	
Yes	197 [18.1%]	13 [22.8%]	ns	5 [1.9%]	1 [1.0%]	ns	218 [31.3%]	79 [32.0%]	ns
Smoking pack years*	10.5 [14.9]	20.3 [20.7]	<0.03	7.3 [5.0]	6.5 [-]	-	19.0 [11.2]	14.8 [11.8]	<0.006
Vegetables (Servs/day)	1.7 [1.1]	1.7 [1.0]	ns	1.9 [0.3]	1.7 [0.5]	<0.0000	1.4 [0.7]	1.4 [0.8]	ns
Fruits (Servs/day)*	1.8 [1.1]	2.0 [1.5]	ns	1.9 [0.3]	2.0 [0.2]	ns	1.5 [0.9]	1.4 [0.8]	ns
Red meat (Times/week)*	2.4 [1.9]	3.0 [2.1]	<0.02	1.8 [0.6]	2.1 [0.7]	<0.0005	3.3 [1.6]	3.2 [1.9]	ns
BMI, Kg/m ² *	28.0 [6.2]	29.4 [6.0]	ns	24.1 [2.1]	27.0 [3.1]	<0.0000	26.3 [4.0]	27.5 [5.1]	<0.0001
Exercise (Times/week)*	2.4 [2.5]	2.0 [2.7]	ns	0.7 [1.7]	0.06 [0.3]	<0.0002	3.7 [2.6]	2.9 [2.8]	<0.0001
Exercise (Mins/time)*	26.3 [40.0]	13.8 [19.9]	<0.02	22.9 [58.2]	2.3 [11.3]	<0.0006	39.5 [43.4]	48.6 [63.4]	<0.01
Exercise (Mins/week)*	110.3 [219.1]	67.1 [104.0]	ns	86.4 [336.0]	3.4 [17.3]	<0.02	202.7 [268.6]	257.9 [423.9]	<0.02

* Mean [Standard Deviation]

Table 2. Body Mass Index and Breast Cancer Risk

Body Mass Index	Overall OR (95% CI) [Cases/Controls]	Caucasian-American OR (95% CI) [Cases/Controls]	African-American OR (95% CI) [Cases/Controls]
Below 18.5 [Underweight]	1.30 (0.78-2.18) [24/58]	1.34 (0.74-2.44) [20/33]	1.98 (0.20-19.38) [1/6]
18.5 to 24.9 [Healthy weight]	1.0 (ref) [505/1840]	1.0 (ref) [363/963]	1.0 (ref) [20/90]
25.0 to 29.9 [Overweight]	1.08 (0.93-1.25) [505/1654]	1.06 (0.88-1.28) [318/745]	1.05 (0.50-2.19) [27/122]
30 or higher [Obese]	1.19 (1.02-1.39) [434/1313]	1.07 (0.88-1.30) [277/667]	1.02 (0.51-2.06) [40/188]
	p-trend=0.0	p-trend=0.0	p-trend=0.0
	Hispanic-American OR (95% CI) [Cases/Controls]	Tunisian-Arab OR (95% CI) [Cases/Controls]	Polish-Caucasian OR (95% CI) [Cases/Controls]
Below 18.5 [Underweight]	2.25 (0.25-20/16) [1/12]	- (-) [0/0]	0.88 (0.18-4.33) [2/7]
18.5 to 24.9 [Healthy weight]	1.0 (ref) [13/370]	1.0 (ref) [23/165]	1.0 (ref) [86/252]
25.0 to 29.9 [Overweight]	1.37 (0.65-2.92) [19/366]	3.07 (1.70-5.56) [54/100]	0.83 (0.58-1.17) [87/321]
30 or higher [Obese]	1.91 (0.93-3.94) [25/341]	76.42 (9.25-631.12) [1/20]	1.81 (1.22-2.67) [72/116]
	p-trend=0.0	p-trend=0.0	p-trend=0.0

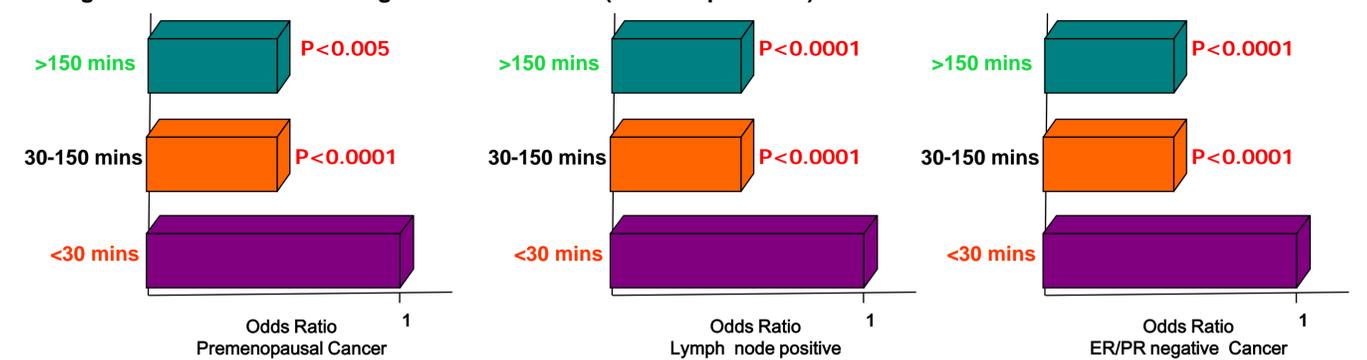
p-value for trend estimated from logistic regression models. Odds Ratios adjusted for age, smoking pack-years and exercise minutes per week. The overall model was also adjusted for race.

Table 3. Exercise and Breast Cancer Risk

	Overall OR (95% CI) [Cases/Controls]	Caucasian-American OR (95% CI) [Cases/Controls]	African-American OR (95% CI) [Cases/Controls]
Exercise (Times/week)			
Tertile 1: <1	1.0 (ref) [660/1433]	1.0 (ref) [390/580]	1.0 (ref) [45/86]
Tertile 2: 1-3	0.50 (0.42-0.58) [324/1464]	0.51 (0.42-0.62) [238/775]	0.34 (0.18-0.66) [12/121]
Tertile 3: >3	0.48 (0.41-0.55) [446/1951]	0.46 (0.39-0.56) [317/1042]	0.21 (0.11-0.39) [21/199]
	P _{trend} =0.0001	P _{trend} =0.0001	P _{trend} =0.0001
Exercise (Mins/time)			
Tertile 1: <10 mins	1.0 (ref) [675/1525]	1.0 (ref) [402/634]	1.0 (ref) [48/96]
Tertile 2: 10-30 mins	0.46 (0.40-0.54) [373/1733]	0.57 (0.48-0.69) [302/869]	0.28 (0.15-0.51) [22/180]
Tertile 3: >30 mins	0.61 (0.53-0.71) [420/1602]	0.51 (0.42-0.62) [274/905]	0.27 (0.14-0.52) [18/130]
	P _{trend} =0.0001	P _{trend} =0.0001	P _{trend} =0.0001
Exercise (Mins/week)			
Tertile 1: <30 mins	1.0 (ref) [671/1539]	1.0 (ref) [398/619]	1.0 (ref) [48/99]
Tertile 2: 30-150 mins	0.47 (0.40-0.54) [325/1579]	0.52 (0.43-0.63) [259/832]	0.31 (0.16-0.57) [20/143]
Tertile 3: >150 mins	0.62 (0.54-0.72) [472/1747]	0.55 (0.46-0.67) [321/957]	0.25 (0.14-0.52) [20/164]
	P _{trend} =0.0001	P _{trend} =0.0001	P _{trend} =0.0001
	Hispanic-American OR (95% CI) [Cases/Controls]	Tunisian-Arab OR (95% CI) [Cases/Controls]	Polish-Caucasian OR (95% CI) [Cases/Controls]
Exercise (Times/week)			
Tertile 1: <1	1.0 (ref) [32/422]	1.0 (ref) [93/201]	1.0 (ref) [100/144]
Tertile 2: 1-3	0.38 (0.18-0.81) [9/328]	0.42 (0.13-1.3) [4/44]	0.40 (0.27-0.60) [54/196]
Tertile 3: >3	0.68 (0.36-1.3) [15/334]	- (-) [0/21]	0.38 (0.26-0.53) [93/355]
	P _{trend} =0.14	P _{trend} =0.009	P _{trend} =0.0001
Exercise (Mins/time)			
Tertile 1: <10 mins	1.0 (ref) [32/434]	1.0 (ref) [93/200]	1.0 (ref) [100/161]
Tertile 2: 10-30 mins	0.64 (0.35-1.18) [18/388]	- (-) [0/15]	0.18 (0.11-0.28) [31/286]
Tertile 3: >30 mins	0.49 (0.21-1.14) [8/267]	0.32 (0.10-1.01) [4/51]	0.78 (0.55-1.09) [116/249]
	P _{trend} =0.06	P _{trend} =0.03	P _{trend} =0.5
Exercise (Mins/week)			
Tertile 1: <30 mins	1.0 (ref) [32/462]	1.0 (ref) [93/201]	1.0 (ref) [100/158]
Tertile 2: 30-150 mins	0.64 (0.33-1.26) [13/325]	0.47 (0.15-1.48) [4/37]	0.20 (0.12-0.31) [29/242]
Tertile 3: >150 mins	0.76 (0.38-1.54) [13/302]	- (-) [0/28]	0.64 (0.45-0.89) [118/296]
	P _{trend} =0.33	P _{trend} =0.009	P _{trend} =0.059

p-value for trend estimated from logistic regression models. Odds Ratios adjusted for age, smoking pack-years and BMI. The overall model was also adjusted for race.

Figure 1. Breast Cancer Categories and Exercise (minutes per week)



Conclusions

We observed a consistent reduction in breast cancer risk with increased recreational exercise. This reduction in risk was observed in all race groups, with African-Americans benefiting the most. Thirty minutes of exercise per week was sufficient in all race categories to achieve benefit. Body mass index was associated with breast cancer risk in all the race groups combined category and among Polish-Caucasians and Tunisian-Arabs. Risk of all breast cancers, pre-menopausal, peri-menopausal, post-menopausal, receptor positive, receptor negative, node positive and node negative were reduced with recreational exercise.