

Cardiorespiratory Fitness and Body Mass Index with Gastroesophageal Reflux Disease in Older Adults

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ABSTRACT

PURPOSE

To examine the associations of cardiorespiratory fitness (CRF) and body mass index (BMI) with prevalence of Gastroesophageal reflux disease (GERD) in older adults.

METHODS

This cross sectional study included 566 older adults (57% women; 72 years old) who were without heart attack, stroke, or cancer in the past 5 years. CRF was assessed via a 400-meter walk test and the minutes to complete the test were divided into sex-specific quartiles (fourths). Participants were categorized into normal weight (<25 kg/m²), overweight (25-29 kg/m²), and obese (≥30 kg/m²) BMI groups. GERD cases were identified via self-report on a medical history questionnaire. Logistic regression was used to calculate the odds ratios (ORs) and 95% confidence intervals (CIs) of GERD among CRF quartiles and BMI groups while adjusting for sex, age, smoking, heavy alcohol consumption, meeting walking guidelines based on ≥7,500 steps/day, and BMI (in CRF analyses) or CRF (in BMI analyses).

RESULTS

Of the 566 adults, there were 123 (22%) GERD cases. Compared with the first quartile of CRF (least fit), the ORs (95% CIs) of having GERD were 0.70 (0.40-1.22), 0.65 (0.37-1.16), and 0.46 (0.25-0.87) among those in the second, third, and fourth (fittest) quartiles of CRF, respectively, after adjusting for all confounders except BMI. However, these associations were not significant after adjusting for BMI. Compared with the normal weight group, the ORs (95% CIs) of having GERD were 2.67 (1.51-4.72) and 4.32 (2.30-8.09) among the overweight and obese groups, respectively, after adjusting for all confounders including CRF. In a joint analysis, compared with the unfit (first quartile of CRF) and obese, ORs (95% CIs) were 0.13 (0.03-0.48), 0.41 (0.17-0.96), 0.17 (0.08-0.36), 0.44 (0.23-0.83), and 0.53 (0.26-1.07) for the unfit-normal weight, unfit-overweight, fit-normal weight, fit-overweight, and fit-obese, respectively, after adjusting for all confounders.

CONCLUSION

Although both CRF and BMI appears to be associated with GERD in this sample of older adults, BMI was found to be more strongly associated with GERD independent of CRF. Among obese individuals, having high CRF may be associated with lower odds of GERD, but more research is warranted.

INTRODUCTION

Gastroesophageal reflux disease (GERD) is caused by frequent acid reflux, and is the most common form of upper gastrointestinal disorder in the elderly. The independent and combined associations of cardiorespiratory fitness (CRF) and body mass index (BMI) with Gastroesophageal reflux disease (GERD) in older adults is unclear.

METHODS

STUDY DESIGN: Cross-sectional

PARTICIPANTS:

• Participants were 566 men and women aged 65 to 95 years (mean age, 72) who formed part of the Physical Activity and Aging Study (PAAS).

• All were without heart attack, stroke, or cancer in the past 5 years.

CARDIORESPIRATORY FITNESS (CRF):

• CRF was assessed using a 400-meter walk test in which participants were asked to complete 20 laps of 20 meters as fast as possible.

• The time taken (in minutes) to complete the test was then divided into sex-specific quartiles (fourths).

BODY MASS INDEX (BMI):

• Participants were categorized into normal weight (<25kg/m²), overweight (25-29kg/m²), and obese (≥30 kg/m²) BMI groups.

GASTROESOPHOGEAL REFLUX DISEASE (GERD):

• GERD cases were identified via self-report on a medical history questionnaire.

STATISTICAL ANALYSIS:

• Logistic regression was used to calculate the odds ratios (ORs) and 95% confidence intervals (CIs) of GERD among CRF quartiles and BMI groups while adjusting for sex, age, smoking, heavy alcohol consumption, meeting walking guidelines based on ≥7,500 steps/day, and BMI (in CRF analyses) or CRF (in BMI analyses).

Table 1. Baseline characteristics of the 566 participants by quartiles of cardiorespiratory fitness

Characteristic	Quartiles of cardiorespiratory fitness				p-value
	1 (Low)	2	3	4 (High)	
Female, n (%)	140 (57)	144 (56)	142 (56)	140 (56)	1.000
Gastroesophageal reflux disease, n (%)	40 (28.6)	31 (21.5)	30 (21.3)	22 (15.7)	0.076
Cardiorespiratory fitness (minutes to complete a 400-meter walk test)	5.8 (1.0)	4.6 (0.2)	4.2 (0.2)	3.8 (0.5)	<0.001
Age (years)	75.2 (6.7)	72.7 (5.8)	70.4 (4.6)	69.0 (4.2)	<0.001
Body mass index (kg/m ²) ^a	29.8 (5.9)	28.1 (4.5)	27.3 (4.0)	25.1 (3.7)	<0.001
Current smoker, n (%)	2 (1.4)	2 (1.4)	1 (0.7)	0 (0)	0.533
Heavy alcohol consumption ^b , n (%)	7 (5.0)	12 (8.3)	11 (7.8)	9 (6.4)	0.693
Physical activity ^c , n (%)	9 (6.4)	35 (24.3)	35 (24.7)	50 (35.7)	<0.001

Data are presented as mean (SD) or N (%). Quartile 1 represents participants with the lowest cardiorespiratory fitness, and quartile 4 represents participants with the highest cardiorespiratory fitness. Baseline differences in continuous variables were assessed using general linear model (F-test), and categorical variables were assessed using chi-square tests. ^aWeight in kilograms divided by the square of the height in meters. ^bHeavy drinking status was obtained via self-report, and was defined as consuming >7 drinks/week for females, or >14 drinks/week for males. ^cPhysical activity was dichotomized into active or non-active categories based on the accumulation of 7,500 steps/day over a one week period, and was assessed by the use of a pedometer.

Table 2. Odds ratios of gastroesophageal reflux disease by quartiles of cardiorespiratory fitness

	Quartiles of cardiorespiratory fitness				P for linear trend
	1 (Low)	2	3	4 (High)	
No. of participants	140 (57)	144 (56)	142 (56)	140 (56)	
No. of GERD	40 (28.6)	31 (21.5)	30 (21.3)	22 (15.7)	
Model 1 ^a	1.00 (referent)	0.66 (0.38 – 1.15)	0.63 (0.35 – 1.11)	0.43 (0.23 – 0.80)	0.010
Model 2 ^b	1.00 (referent)	0.70 (0.40 – 1.22)	0.65 (0.37 – 1.16)	0.46 (0.25 – 0.87)	0.020
Model 3 ^c	1.00 (referent)	0.86 (0.49 – 1.54)	0.94 (0.50 – 1.74)	0.82 (0.40 – 1.68)	0.665

GERD, gastroesophageal reflux disease. Quartile 1 represents participants with the lowest cardiorespiratory fitness. ^aModel 1 was adjusted for baseline age (years) and sex. ^bModel 2 was adjusted for Model 1 plus current smoking status (current or non-smoker), heavy alcohol consumption, and physical activity (≥7,500 steps/day). ^cModel 3 was adjusted for Model 2 plus body mass index (kg/m²).

Table 3. Odds ratios of gastroesophageal reflux disease by tertiles of body mass index

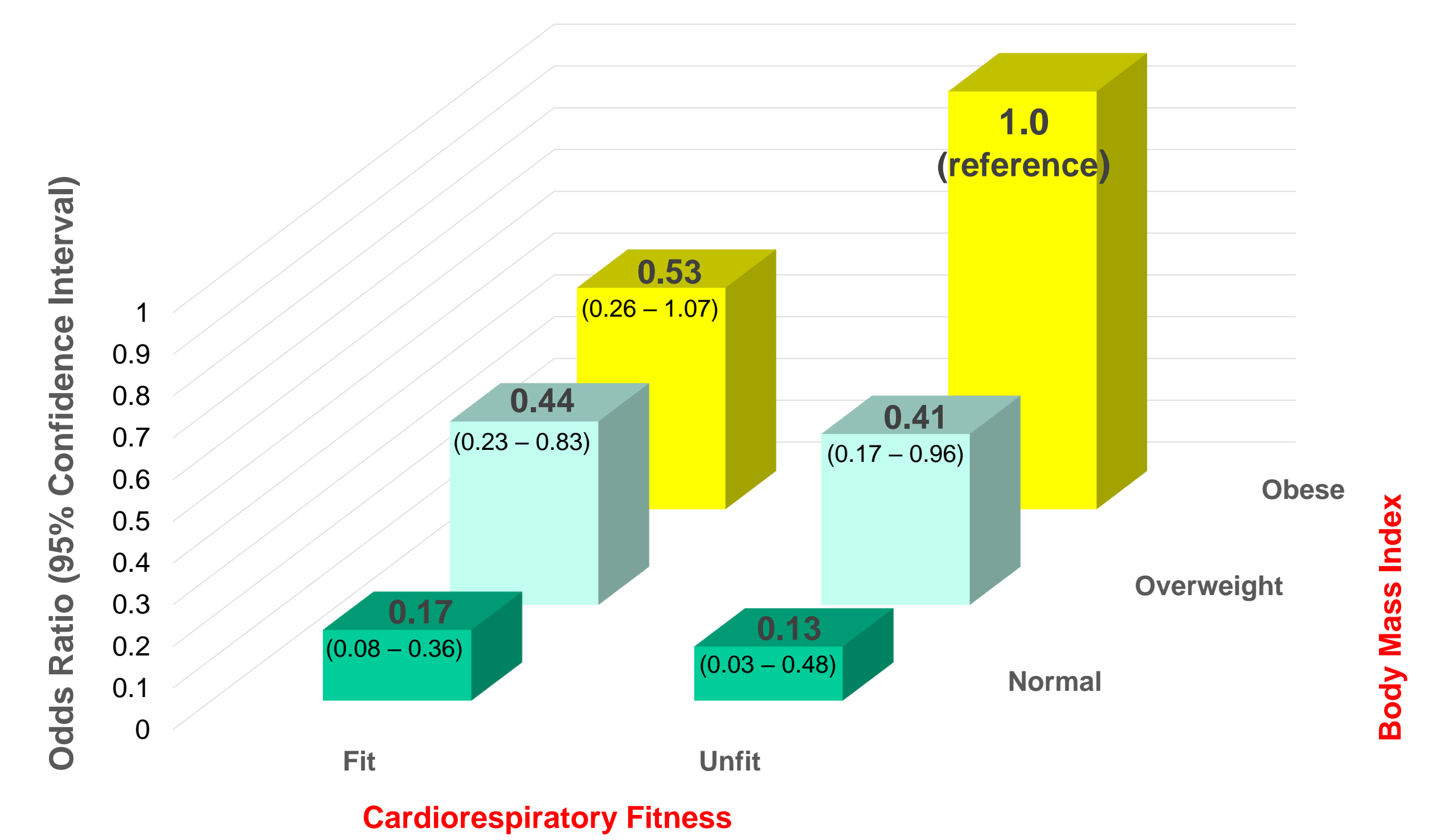
	Body mass index (kg/m ²)			P for linear trend
	Obese (≥30.0)	Overweight (25.0-29.9)	Normal Weight (<25.0)	
No. of participants	131 (70)	119 (52)	70 (47)	
No. of GERD	20 (10.8)	54 (23.5)	49 (32.7)	
Model 1 ^a	1.00 (referent)	0.23 (0.13 – 0.41)	0.61 (0.38 – 0.97)	<0.001
Model 2 ^b	1.00 (referent)	0.24 (0.13 – 0.43)	0.63 (0.39 – 0.99)	<0.001
Model 3 ^c	1.00 (referent)	0.23 (0.12 – 0.44)	0.62 (0.38 – 0.999)	<0.001

GERD, gastroesophageal reflux disease. Tertile 1 indicates obesity (body mass index ≥ 30 kg/m²), tertile 2 indicates overweight (25 kg/m² ≤ body mass index <30kg/m²), and tertile 3 indicates normal weight (body mass index <25 kg/m²). ^aModel 1 was adjusted for baseline age (years) and sex. ^bModel 2 was adjusted for Model 1 plus current smoking status (current or non-smoker), heavy alcohol consumption, and physical activity (≥7,500 steps/day). ^cModel 3 was adjusted for Model 2 plus cardiorespiratory fitness (kg/m²).

CONCLUSION

- High CRF was significantly associated with reduced odds of GERD, but this association was **not significant** after adjusting for BMI.
- Higher BMI was significantly associated with reduced odds of GERD, with the association **remaining significant** even after adjusting for CRF.
- Joint analyses showed that **being obese and fit** was associated with a 47% reduced odds of suffering from GERD, though this was not significant.

Figure 1. Odds ratios (95% confidence intervals) of gastroesophageal reflux disease by combined categories of cardiorespiratory fitness and body mass index



Key

Models were adjusted for sex, age, smoking status (current or non-smoker), heavy alcohol consumption (>7 drinks/week for females and >14 drinks/week for males).

Fit

Upper 75% of cardiorespiratory fitness observations.

Unfit:

Lowest 25% of cardiorespiratory fitness observations.

Normal:

Body mass index <25 kg/m²

Overweight:

25 kg/m² ≤ body mass index <30 kg/m²

Obese:

Body mass index ≥ 30 kg/m²

Table 4: Case numbers of gastroesophageal reflux disease among participants in combined categories of cardiorespiratory fitness and body mass index.

	Unfit (case / n)	Fit (case / n)
Obese	25 / 58	24 / 92
Overweight	12 / 49	42 / 181
Normal	3 / 32	17 / 154

LIMITATIONS

- Cross sectional study design
- GERD history obtained via self-report
- Study participants are relatively healthier and fitter.