Associations between Cardiorespiratory Fitness and Diverticulitis in Older Adults

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ABSTRACT

Purpose: The purpose of this study was to examine the independent and joint associations of cardiorespiratory fitness (CRF) and body mass index (BMI) with the prevalence of diverticulitis in older adults on which there is limited data.

Methods: This cross-sectional study included 476 older adults (61% women; mean age 71 years old) with no history of myocardial infarction, stroke, cancer, inflammatory bowel disease, or type 2 diabetes. CRF was assessed by time (minutes) to complete a 400-meter walk test. BMI was calculated using measured weight (kg) divided by height (meter) squared. Participants were categorized into sex-specific tertiles (thirds) of CRF. The cases of diverticulitis were identified by physician diagnosis from a standardized medical history questionnaire. Multivariable logistic regression was used to calculate the odds ratios (ORs) and 95% confidence intervals (CIs) of the prevalence of diverticulitis by tertiles of CRF. CRF and BMI were further dichotomized into either “unfit” (the lowest one-third of CRF), “overweight/obese” (BMI ≥ 25.0 kg/m^2), “fit” (the upper two-thirds of CRF), or “normal-weight” (BMI < 25.0 kg/m^2) to investigate the joint association of CRF and BMI with diverticulitis.

Results: There were 35 diverticulitis cases (7.4%). Compared with the lower CRF, the ORs (95% CIs) of diverticulitis were 0.52 (0.22-1.22) and 0.33 (0.12-0.94) in the middle and upper CRF, respectively, after adjusting for possible confounders. However, the association was no longer significant after further adjustment for BMI. Compared with the normal-weight, the ORs (95% CIs) of diverticulitis were 2.86 (1.05-7.79) and 2.98 (0.95-9.35) in the overweight and obese, respectively, after adjusting for possible confounders including CRF. In the joint analysis of CRF and BMI, compared with the “overweight/obese and unfit,” ORs (95% CIs) were 0.57 (0.24-1.38) in the “overweight/obese and fit,” 0.65 (0.16-2.59) in the “normal-weight and unfit,” and 0.16 (0.04-0.61) in the “normal-weight and fit” group.

Conclusions: Higher CRF and lower BMI appear to be associated with a lower prevalence of diverticulitis in older adults. The lowest prevalence of diverticulitis was found in the normal-weight and fit older adults. Prospective studies are warranted.

INTRODUCTION

Diverticulitis is a common 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 476 men and women aged 65 to 95 years (mean age, 71) who formed part of the Physical Activity and Aging Study (PAAS).

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 tertiles (Thirds).

BODY MASS INDEX (BMI):

- Participants were categorized into normal weight (<25kg/m^2), overweight (25-29kg/m^2), and obese (≥30 kg/m^2) BMI groups.

DIAGNOSIS OF DIVERTICULITIS:

- Cases of diverticulitis were identified by self-reported physician diagnosis from the medical history questionnaire where participants were asked, "Have you ever been diagnosed with diverticulitis by a physician?" If yes, the year of diagnosis was obtained, which was also considered in diverticulitis diagnosis.

STATISTICAL ANALYSIS:

- Logistic regression was used to calculate the odds ratios (ORs) and 95% confidence intervals (CIs) of diverticulitis among CRF quartiles and BMI groups while adjusting for sex, age, smoking, heavy alcohol consumption, physical activity, meals, vegetable, fruit, non-steroidal anti-inflammatory drug use, hypercholesterolemia, and hypertension. and BMI (in CRF analyses) or CRF (in BMI analyses).

RESULTS

Table 1. Baseline characteristics by cardiorespiratory fitness and body mass index categories.

		Tertiles of Cardiorespiratory Fitness				Body Mass Index			
Characteristic	**All**	**Lower**	**Middle**	**Upper**	**P value**	**Normal Weight (<25.0 kg/m²)**	**Overweight (25.0-29.9 kg/m²)**	**Obese (≥30.0 kg/m²)**	**P value**
N	476	156	163	157		169	187	120	
Female, n (%)	293 (61)	95 (60)	103 (63)	95 (60)	0.867	123 (72)	109 (58)	61 (50)	<.0001
Age (years)	71.2 (5.4)	74.1 (5.9)	70.7 (4.9)	68.8 (3.8)	<.0001	71.8 (5.7)	71.2 (5.3)	70.3 (5.0)	0.084
Body mass index (kg/m²)[a]	27.2 (4.7)	29.1 (5.3)	27.4 (4.2)	25.2 (3.7)	<.0001	22.7 (1.8)	27.3 (1.4)	33.5 (3.3)	<.0001
Physical activity (steps/day)	5684 (2998)	4503 (2475)	5858 (2859)	6674 (3220)	<.0001	5930 (2928)	5828 (3126)	5110 (2836)	0.050
Cardiorespiratory fitness (min)[b]	4.5 (0.8)	5.3 (0.8)	4.4 (0.2)	3.8 (0.3)	<.0001	4.3 (0.6)	4.4 (0.6)	4.9 (1.0)	<.0001
Smoking status, n (%)					0.488				0.387
Never smoked	325 (68)	102 (65)	113 (69)	110 (70)		114 (67)	133 (71)	78 (65)	
Former Smoker	146 (30)	51 (32)	48 (29)	47 (29)		52 (30)	54 (28)	40 (33)	
Current smoker	5 (1)	3 (1)	2 (1)	0 (0)		3 (1)	0 (0)	2 (1)	
Heavy alcohol drinking, n (%)[c]	39 (8)	15 (9)	11 (6)	13 (8)	0.646	15 (8)	14 (7)	10 (8)	0.891
Meal intake (meals/week)	19.6 (4.0)	19.5 (3.0)	19.5 (2.4)	19.9 (5.8)	0.495	20.0 (2.7)	19.1 (4.9)	20.0 (3.9)	0.045
Vegetable intake (cups/day)	2.1 (3.5)	2.1 (3.1)	2.2 (4.9)	2.1 (2.0)	0.958	2.1 (1.7)	2.5 (5.3)	1.7 (1.1)	0.192
Fruit intake (cups/day)	2.2 (4.7)	2.1 (3.4)	2.4 (7.0)	2.1 (2.1)	0.767	2.0 (1.1)	2.7 (7.3)	1.7 (1.2)	0.127
Use of NSAIDs, n (%)[d]	104 (21)	44 (28)	34 (20)	26 (16)	0.042	21 (12)	49 (26)	34 (28)	0.001
Hypercholesterolemia, n (%)[e]	240 (50)	88 (56)	83 (50)	69 (43)	0.087	67 (39)	102 (54)	71 (59)	0.002
Hypertension, n (%)[f]	261 (55)	101 (65)	94 (58)	66 (42)	<.0001	70 (41)	109 (58)	82 (68)	<.0001

Data are presented as mean (SD) unless indicated otherwise.
[a] Weight in kilograms divided by height in meters squared.
[b] Cardiorespiratory fitness is time to complete a 400-meter walk test.
[c] Heavy drinking is >7 drinks/week for women and >14 drinks/week for men.
[d] Taking non-steroidal anti-inflammatory drugs (NSAIDs), such as aspirin or ibuprofen.
[e] Defined as systolic/diastolic blood pressure ≥ 130/80mmHg, self-reported diagnosed hypertension, and/or taking blood pressure medication.
[f] Defined as low-density lipoprotein cholesterol ≥160 mg·dL^{-1}, self-reported diagnosed high cholesterol, and/or taking cholesterol medication.

Table 2. Odds ratios (ORs) and 95% confidence intervals (95% CIs) for diverticulitis according to cardiorespiratory fitness and body mass index.

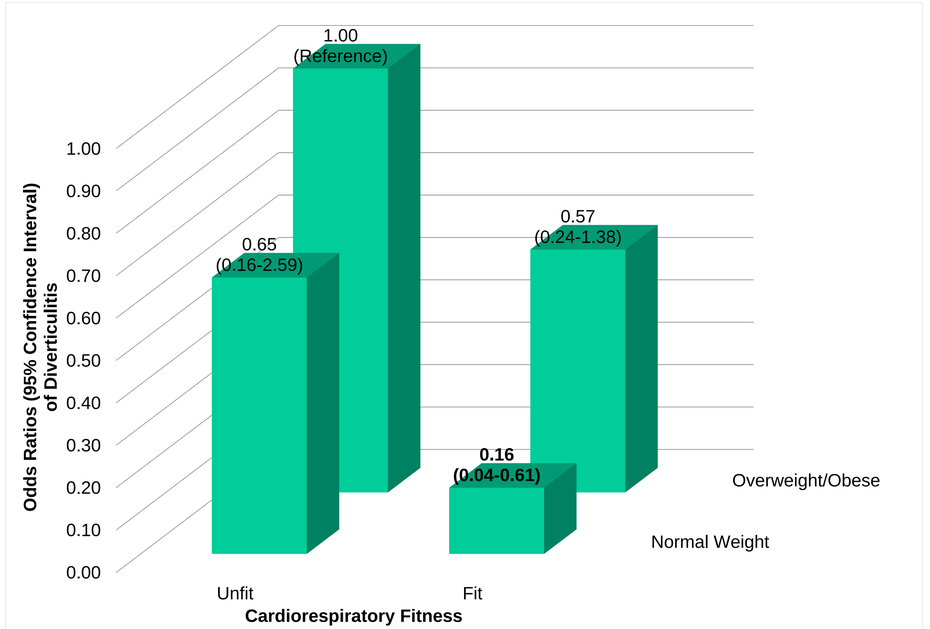
			Model 1	Model 2	Model 3
	n	**Cases**	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**
Tertiels of Cardiorespiratory Fitness					
Lower CRF	156	17	1.00 (reference)	1.00 (reference)	1.00 (reference)
Middle CRF	163	11	0.50 (0.22-1.15)	0.52 (0.22-1.22)	0.55 (0.23-1.33)
Upper CRF	157	7	**0.30 (0.11-0.80)**	**0.33 (0.12-0.94)**	0.37 (0.12-1.10)
P for linear trend			**0.013**	**0.033**	0.067
Per minute in walking time			1.18 (0.75-1.86)	1.06 (0.64-1.78)	0.89 (0.49-1.63)
Body Mass Index					
Normal weight (<25.0 kg/m²)	169	6	1.00 (reference)	1.00 (reference)	1.00 (reference)
Overweight (25.0-29.9 kg/m²)	187	17	**2.85 (1.09-7.46)**	**2.83 (1.04-7.66)**	2.86 (1.05-7.79)
Obese (≥30.0 kg/m²)	120	12	**3.24 (1.16-9.05)**	2.83 (0.96-8.38)	2.98 (0.95-9.35)
P for linear trend			**0.024**	0.068	0.063
Per kg/m² in body mass index			1.06 (0.99-1.14)	1.05 (0.98-1.13)	1.06 (0.97-1.15)

Model 1 was adjusted for sex and age (years).

Model 2 was adjusted for Model 1 plus smoking status (never, former, current), heavy alcohol drinking (yes or no), physical activity (steps/day), meals/week (quintiles), vegetable cups/day (quintiles), fruit cups/day (quintiles), non-steroidal anti-inflammatory drugs use (yes or no), hypercholesterolemia (yes or no), hypertension (yes or no).

Model 3 was adjusted for model 2 plus body mass index (kg/m²) for CRF or CRF (min) for body mass index.

Figure 1. Joint associations of cardiorespiratory fitness and body mass index with diverticulitis.



Participants were divided into four groups based on combined categories of cardiorespiratory fitness (unfit or fit) and body mass index (normal-weight, overweight/obese), respectively. "Unfit" was the lower third of cardiorespiratory fitness and "fit" was the upper two thirds of cardiorespiratory fitness. Normal weight was body mass index < 25.0kg/m^2, overweight/obese was ≥ 25.0kg/m^2. The model was adjusted for sex, age (years), smoking status (never, former, current), heavy alcohol drinking (yes or no), physical activity (steps/day), meals/week (quintiles), vegetable cups/day (quintiles), fruit cups/day (quintiles), non-steroidal anti-inflammatory medication use (yes or no), hypercholesterolemia (yes or no), and hypertension (yes or no). The number of participants (cases of diverticulitis) in the “overweight/obese unfit,” “overweight/obese and fit,” “normal weight unfit,”, and “normal weight fit” groups were 117 (14), 190 (15), 39 (3), and 130 (3), respectively.

CONCLUSIONS

1. Higher CRF and lower BMI appear to be associated with a lower prevalence of diverticulitis in older adults.
2. Higher CRF combined with lower BMI is more strongly associated with a lower prevalence of diverticulitis.

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