

## Exercise intensity is associated with progression of coronary artery calcification in middle-aged and older athletes: findings from the MARC-2 study

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**Funding Acknowledgements:** Type of funding sources: Foundation. Main funding source(s): Dutch Heart Foundation

### Background

Recent studies have reported increased coronary artery calcification (CAC) in middle-aged male athletes, which is related to the amount and intensity of lifelong exercise. However, previous studies are limited by their cross-sectional study design.

### Purpose

We prospectively assessed progression of CAC and its association to exercise volume and intensity in middle-aged and older athletes.

### Methods

318 asymptomatic middle-aged and older men were recruited in the Measuring Athlete's Risk of Cardiovascular events (MARC) study between 2012-2014 and invited for follow-up (MARC-2) between 2019-2020. During both study visits, computed tomography imaging was performed to assess CAC. Exercise characteristics during follow-up were used to calculate exercise volumes (Metabolic equivalent of task [MET]-hours/week), whereas intensities were classified as moderate (3-6 MET), vigorous (6-9 MET) and very vigorous (>9 MET). For linear regression analyses, CAC scores were transformed (Ln delta CAC score + 1) and analyses were adjusted for baseline confounders, CAC at baseline and time between CT scans. Exercise intensities were assessed as proportion of MET-hrs/week and separately included, while adjusting for exercise volume.

### Results

We included 289 men (54.9 ± 6.4 years) for MARC-2, with a follow-up of 6.3 ± 0.5 years. Participants exercised for 41 [25-57] MET-hrs/week, of which the median percentage was 0% [interquartile range 0-19] at moderate, 44% [0-84] at vigorous and 34% [0-80] at very vigorous intensity. At baseline, CAC was present in 151 (52%) men, and increased to 205 (71%) men at follow-up. CAC scores increased from 1 [0-32] to 31 [0-132]. Delta CAC score (26 [0-104]) was not associated with overall exercise volume. However, delta CAC score was negatively associated with vigorous intensity exercise and positively associated with very vigorous intensity exercise (Table).

### Conclusion

Progression of CAC was not associated with overall exercise volume during 6-year follow-up. However, the degree of vigorous intensity exercise was associated with attenuated CAC progression, whereas very vigorous intensity exercise was associated with accelerated CAC progression.

Linear regression analyses

Progression of CAC (Ln Delta CAC score +1)	B (95% CI)	P-Value
Exercise volume (MET-hours/week)	.001 (-.005 - .008)	.70
Exercise Intensity		
Moderate intensity (%)	-.002 (-.009 - .005)	.65
Vigorous intensity (%)	-.005 (-.009 - .000)	.03
Very vigorous intensity (%)	.005 (.001 - .009)	.02