Predictors of coronary atherosclerosis in middle-aged and older endurance athletes

K. Berge¹, V.L. Aengevaeren², A. Mosterd³, B.K. Velthuis⁴, T.M.H. Eijsvogels²

¹Akershus University Hospital, Department of Cardiology, Oslo, Norway
²Radboud Institute for Health Sciences, Department of Physiology, Nijmegen, Netherlands (The)
³Meander Medical Center, Department of Cardiology, Amersfoort, Netherlands (The)
⁴University Medical Center Utrecht, Department of Radiology, Utrecht, Netherlands (The)

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**Background:** Exercise improves cardiovascular health, but emerging evidence indicates that coronary atherosclerosis is more prevalent in middle-aged and older endurance athletes than sedentary peers. It has been shown that greater lifelong exercise volumes and exercise training at a very vigorous intensity are associated with higher coronary artery calcification scores (CACS). Nevertheless, the underlying mechanisms responsible for accelerated coronary atherosclerosis in veteran athletes are unknown and largely unexplored.

**Purpose:** To identify predictors of CACS in middle-aged and older endurance athletes.

**Methods:** Cardiac CT scans were performed on 284 middle-aged and older male athletes of the MARC-2 study to assess CACS. Participants were stratified to CACS=0, CACS: 1-100, CACS: 101-400, or CACS >400. Participant characteristics, traditional cardiovascular risk factors, biomarker concentrations, nutrition characteristics, perceived stress scores, and usage of immune-modulating and performance-enhancing drugs were compared across CACS subgroups, whereas linear regression with backward elimination was used to determine associations with ln(CACS + 1).

**Results:** Participants were 60.0 [Q1-3 56.3-66.0] years old, had a weekly training load of 25.7 [16.9-35.2] MET-h, BMI of 24.5 [22.9-26.7] kg/m², systolic blood pressure (SBP) of 140±18 mmHg, and reported 0.3 [0.0-8.0] smoking pack years. CACS was 31 [0-132], with 29% of athletes having CACS of 0, 40% 1-100, 18% 101-400, and 13% >400. Participants with CACS >400 were older (p<0.001), had higher SBP (p=0.004), had smoked more pack years (p=0.003), and had more often a family history of cardiovascular disease (p=0.001), compared to lower CACS groups. After backward selection, our final multivariable model (R²=0.12) revealed that alcohol intake (p=0.021), smoking pack years (p=0.027), and SBP (p=0.004) had a positive relationship with CACS, while total fat intake (p=0.005) had an inverse relationship with CACS. We also found a significant interaction effect between weekly training load with alcohol consumption (p=0.017) and SBP (p=0.028), indicating that the association of alcohol and SBP with CACS was stronger for individuals performing higher exercise volumes.

**Conclusion:** Alcohol consumption, smoking history, and SBP were the strongest predictors of CACS in our cohort of middle-aged and older male endurance athletes, whereas the effect size of alcohol consumption and SBP on CACS was larger for participants with higher training loads. Our findings indicate that high exercise volumes do not eliminate the cardiovascular risk associated with an unhealthy lifestyle.