

Johansen et al. Risk of atrial fibrillation and stroke among older men exposed to prolonged endurance sport practice – a 10-year follow-up. The Birkebeiner Ageing Study and the Tromsø Study

SUPPLEMENTARY MATERIAL

Table S1.

Baseline characteristics of participants from the Birkebeiner Ageing Study (athletes) according to those who attended follow-up in 2020 and those who did not.

Baseline characteristics	Attended follow-up (n=353)	Did not attend follow-up in 2020 (n=152)	p-value
Age	67 (65 – 71)	69 (66 – 73)	<0.001
Height (cm)	178 (175 – 182)	177 (173 – 182)	0.06
Weight (kg)	75 (70 – 80)	75 (69 – 80)	0.64
BMI (kg·m ⁻²)	23.4 (22.2 – 24.7)	23.7 (22.5 – 24.9)	0.38
	% (n)	% (n)	
Education			<0.01
Primary/Secondary school	12.3 (43)	26.7 (40)	
High School	43.4 (152)	39.3 (59)	
College/University	44.3 (155)	34.0 (51)	
Smoking status			0.15
Current	0.6 (2)	1.3 (2)	
Former	35.5 (125)	43.4 (66)	
Never	63.9 (225)	55.3 (84)	
Frequency of alcohol consumption			0.34
Never	9.1 (31)	10.3 (15)	
1-4 times per month	74.3 (254)	69.9 (102)	
2-3 times a week	13.2 (45)	17.8 (26)	
4 times or more per week	3.5 (12)	2.1 (3)	
Coronary heart disease	3.4 (12)	4.0 (6)	0.75
Previous stroke	2.0 (7)	0.7 (1)	0.27
Atrial fibrillation	14.2 (50)	12.7 (19)	0.65
Diabetes	0.6 (2)	1.3 (2)	0.38
Currently or previously on antihypertensive medication	14.0 (47)	19.9 (29)	0.10
Self-reported physical activity			0.20
Sedentary	0.3 (1)	0.0 (0)	
Light	8.1 (28)	13.8 (20)	
Moderate	51.0 (177)	51.0 (74)	
Vigorous	40.6 (141)	35.2 (51)	

Values are presented as median (25th and 75th percentile) for continuous variables and as percentages for categorical variables.

Table S2.

Baseline characteristics in the Tromsø Study (Tromsø6) (non-athletes) according to those who attended follow-up and those who did not.

Baseline characteristics	Attended follow-up (n = 1033)	Did not attend follow-up (n = 834)	p-value
Age	69 (66 – 73)	73 (68 – 78)	<0.01
Height (cm)	175 (170.6 – 179.2)	174.1 (169.6 – 178.3)	<0.01
Weight (kg)	81.9 (74.4 – 90.7)	79.9 (71.9 – 89.0)	<0.01
BMI (kg·m ⁻²)	26.9 (24.6 – 29.2)	26.5 (24.2 – 29.2)	
	% (n)	% (n)	
Education			<0.01
Primary/Secondary school	27.8 (280)	45.5 (366)	
High School	38.6 (389)	32.3 (260)	
College/University	33.6 (339)	22.2 (179)	
Smoking status			<0.01
Current	11.9 (121)	20.0 (160)	
Former	60.7 (618)	60.6 (485)	
Never	27.5 (280)	19.5 (156)	
Frequency of alcohol consumption			<0.01
Never	10.4 (106)	18.9 (153)	
1-4 times per month	65.9 (670)	61.8 (499)	
2-3 times a week	16.5 (168)	14.4 (116)	
4 times or more per week	7.2 (73)	5.0 (40)	
Coronary heart disease	18.7 (190)	31.3 (254)	<0.01
Previous stroke	5.3 (53)	9.2 (73)	<0.01
Atrial fibrillation	9.7 (96)	15.6 (15.6)	<0.01
Diabetes	6.1 (62)	11.5 (92)	<0.01
Currently or previously on antihypertensive medication	35.4 (356)	46.8 (373)	<0.01
Self-reported physical activity			<0.01
Sedentary	14.6 (136)	25.8 (178)	
Light	57.9 (540)	58.2 (401)	
Moderate	26.6 (248)	15.5 (107)	
Vigorous	1.0 (9)	0.4 (3)	

Values are presented as median (25th and 75th percentile) for continuous variables and as percentages for categorical variables.

Figure S1.

Simplified directed acyclic graph depicting the total effect model (model 2). Green node with “►” illustrates exposures. Blue node with “I” illustrates outcomes. White nodes illustrate covariates that have been conditioned on. Blue nodes indicate descendant of the exposure and ancestor of the outcome. Black arcs depict blocked pathways, green arcs indicate causal pathways. BMI: Body mass index, CHD: Coronary heart disease.

Figure S2.

Simplified directed acyclic graph depicting the direct effect model (model 3). Green node with “►” illustrates exposures. Blue node with “I” illustrates outcomes. White nodes illustrate covariates that have been conditioned on. Black arcs depict blocked pathways, green arcs indicate causal pathways. BMI: Body mass index, CHD: Coronary heart disease.

Figure S3.

Simplified directed acyclic graph depicting body mass index, blood pressure, diabetes and coronary heart disease as potential sources of confounding bias in model 2. Green node with “►” illustrates exposures. Blue node with “I” illustrates outcomes. White nodes illustrate covariates that have been conditioned on. Red nodes indicate ancestor of exposure and outcome variables. Red arcs depict biasing pathways, black arcs depict blocked pathways, green arcs indicate causal pathways. BMI: Body mass index, CHD: Coronary heart disease.

Figure S4.

Directed acyclic graph depicting unmeasured variables (gray nodes) that are potential sources of residual confounding bias in model 3. Green node with “►” illustrates exposures. Blue node with “I” illustrates

outcomes. White nodes illustrate covariates that have been conditioned on. Gray nodes indicate unobserved variables. Red arcs depict biasing pathways, black arcs depict blocked pathways, green arcs indicate causal pathways. BMI: Body mass index, CHD: Coronary heart disease. Note that when Atrial fibrillation is applied as an exposure, anticoagulant treatment becomes an ancestor of an exposure and an outcome, and as such is also a potential source of residual confounding bias.

Table S3.

Risk ratio with 95% confidence interval for atrial fibrillation after inclusion of hospital registry confirmed diagnoses in non-athletes who did not attend follow-up.

Exposure	n	Number of cases n (%)	Model 1	Model 2	Model 3
Non-athletes	1864	480 (25.8)	1 Reference	1 Reference	1 Reference
Athletes	505	145 (28.7)	1.24 (1.06 – 1.46)	1.15 (0.96 – 1.37)	1.52 (1.24 – 1.88)

Model 1: Adjusted for age. Model 2: Adjusted model 1 + body height, education, smoking and frequency of alcohol intake. Model 3: Adjusted for model 2 + coronary heart disease, diabetes, body mass index, and antihypertensive medication.

Table S4.

Risk ratio with 95% confidence interval for atrial fibrillation after exclusion of participants reporting overweight, use of antihypertensives, smoking, coronary heart disease and diabetes.

Exposure	n	Number of cases n (%)	Risk ratio (95% CI)
Non-athletes	256	33 (12.9)	1 Reference
Athletes	328	82 (25.0)	1.63 (1.06 – 2.51)

CI: Confidence interval. Adjusted for age, body height, education, previous smoker, and frequency of alcohol intake.

Table S5.

Risk ratio with 95% confidence intervals for atrial fibrillation and stroke in participants aged ≤ 75 years.

Exposure	n	Number of cases n (%)	Model 1	Model 2	Model 3
Atrial fibrillation					
Non-athletes	1387	238 (17.2)	1 Reference	1 Reference	1 Reference
Athletes	469	137 (29.2)	1.72 (1.43 – 2.06)	1.47 (1.20 – 1.80)	1.98 (1.54 – 2.55)
Stroke					
Non-Athletes	1041	91 (8.7)	1 Reference	1 Reference	1 Reference
Athletes	443	21 (4.7)	0.55 (0.35 – 0.87)	0.62 (0.38 – 1.02)	0.73 (0.43 – 1.23)

Model 1: Adjusted for age, Model 2: Additionally adjusted for body height, education, smoking status and frequency of alcohol intake, Model 3: Adjusted for model 2 + coronary heart disease (AF only), diabetes (AF only), body mass index, and antihypertensive medication. For analysis of stroke participants, those reporting coronary heart disease and diabetes at baseline have been excluded.

Table S6.

Risk ratio with 95% confidence interval for stroke with coronary heart disease and diabetes participants included.

Exposure	n	Number of cases n (%)	Model 1	Model 2	Model 3
Non-athletes	1829	183 (10.0)	1 Reference	1 Reference	1 Reference
Athletes	498	28 (5.6)	0.60 (0.41 – 0.89)	0.69 (0.45 – 1.04)	0.83 (0.53 – 1.30)

Model 1: Age adjusted, Model 2: Additionally adjusted for body height, education, smoking status and frequency of alcohol intake, Model 3: Adjusted for model 2 + coronary heart disease, diabetes, body mass index, and antihypertensive medication.