

Evaluating High-performance Female Athletes' Knowledge and Awareness of Atrial Fibrillation

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ABSTRACT

Background: Atrial fibrillation (AFib) is a common cardiac arrhythmia with emerging evidence suggesting a high risk in athletes may exist, especially those engaged in vigorous physical activity. While substantial research has examined male athletes, limited data exists for female athletes, despite their growing presence in elite sports. AFib poses a health risk as it can progress without symptoms, potentially leading to severe complications, including heart failure and stroke. Athletes, accustomed to discomfort in their competitive pursuits, may delay seeking care even after retiring from sport, compounding the issue. **Objectives:** Therefore, we investigated the level of AFib-related knowledge in Canadian females, defined as high-performance athletes who had or were competing at a national or international level. **Methods:** Our online cross-sectional survey employed the 21-question Atrial Fibrillation Knowledge and Assessment Tool (AFKAT), with an additional question to assess awareness of an AFib diagnosis. **Results:** Participants were recruited through research websites and were mostly over 40 years old (45/52), Caucasian (50/52), university educated (39/53), from the sport of curling (41/52), and 62% (32/52) had competed at an international level. The mean knowledge score was 12.63 ± 5.79 out of 21 and was significantly different between international-level athletes (14.22 ± 4.38) when compared to national-level athletes (10.10 ± 6.91 ; $p = 0.011$). **Conclusions:** Varying levels of AFib knowledge were observed within this population, and our results importantly identified a discrepancy based on competition level, with international-level female athletes demonstrating higher AFib knowledge levels. This highlights the necessity for targeted educational interventions, to inform and increase athletes' cardiovascular awareness of the potential risk of AFib.

Key words: Atrial Fibrillation, Female, Athletes, Exercise, and Sports

INTRODUCTION

Atrial fibrillation (AFib) is the most prevalent cardiac arrhythmia worldwide (Achkasov et al., 2019) and the most common arrhythmia affecting athletic populations (Newman et al., 2021), particularly in middle-aged athletes (Turagam et al., 2015). Regular physical activity (PA) has been associated with a reduction in cardiovascular disease and risk of death through various mechanisms, with moderate physical activity known to reduce the overall risk of AFib (Proietti et al., 2017; Sørensen et al., 2022). However, the specific relationship between physical activity and AFib burden remains unclear due to the complicated relationship between exercise intensity and a high training volume (Petrungaro et al., 2023; Sørensen et al., 2022; Tsougos et al., 2022; Stergiou & Duncan, 2018; Zacher et al., 2023).

Numerous studies have documented an association between sustained endurance training and increased AFib risk. For example, a 2021 meta-analysis reported that the relative risk of AFib was higher in athletes than in both sedentary and recreationally active individuals, particularly when physical

activity exceeded national guidelines (Newman et al., 2021). Furthermore, vigorous physical activity has been linked to an increased likelihood of AFib diagnosis, resulting in greater risk for elite or high-performance athletes than their non-athlete counterparts (Stergiou & Duncan, 2018).

Even though this phenomenon of increased lifetime risk of AFib among athletes is well-established most investigations have been sex specific (Claessen et al., 2018; Newman et al., 2021; Sørensen et al., 2022; Stergiou & Duncan, 2018; Zacher et al., 2023) with greater than 90 % of data collected in men (Flannery et al., 2017). The scarcity of data on female athletes' health poses challenges in assessing gender-specific AFib risk (Lobo et al., 2023) within athletic communities despite the growing presence of women in elite sports, the lack of documented gender-related AFib risk factors, and the fact that women have a longer life expectancy than men (Newman et al., 2021; Streur et al., 2017; Wilson et al., 2021).

There is a 94% increased risk of death in individuals who are unaware that they suffer from AFib (McCabe et al., 2017). When untreated, AFib is also known to contribute

to heart failure and is associated with a five-fold increased risk of ischemic stroke (McCabe et al., 2017; Wilson et al., 2021). Therefore, early detection, diagnosis, and treatment of AFib is critical in preventing AFib-related complications and early death (Kirchhof et al., 2016). The normalization of pain in competitive sports within athletic populations only exacerbates this concern as there is a greater likelihood that athletes will ignore new health complaints and delay seeking care, even once retired from sport (Barrette & Harman, 2020; Bekker et al., 2020).

In summary, atrial fibrillation is the most common lasting arrhythmia, strongly age associated, with an increased risk of death greater in those unaware of the condition, and athletes are a select group with a higher-than-average lifetime risk due to their vigorous training intensity. While medical therapies are improving continually, the focus is shifting towards lifestyle where knowledge of the influence of exercise is both a risk factor in athletes and an intervention for prevention (Zacher et al., 2017). Lastly the role of female sex between PA, exercise and AFib is largely under investigated (Myrstad et al., 2023). To date, no published research has investigated the knowledge of AFib in elite (Williams et al., 2017) or high-performance (HP) athletes competing at a national or international level let alone within the female athlete population. Thus, our primary study aim was to evaluate the degree of AFib knowledge in Canadian high-performance female athletes competing at a national or international level.

METHODS

Research Design and Study Population

Our study utilized a cross-sectional study design, administered through the online Qualtrics platform (<https://www.qualtrics.com/>) and participants anonymously accessed the survey on a personal computer/laptop, tablet, or smartphone. We used the common rule of thumb for a pilot study sample size (no previous data available), which is 10-20% of a full-scale survey or at least 30-50 respondents (Viechtbauer et al., 2015). Participants were recruited from February to March 2023 and were at least 30 years of age. Canadian female athletes who had or were competing at a national or international level were considered high-performance athletes. The questionnaire was advertised on the University of Calgary research website, and via posters initially distributed at local curling clubs in Calgary, Alberta. As such, an informal word-of-mouth recruitment method likely occurred. Questionnaires were obtained from 54 individuals and the average survey completion time was 7.1 minutes. Two participants were excluded as one was below the age requirement while the other had not competed above the provincial level.

Instrument

The Atrial Fibrillation Knowledge and Assessment Tool (AFKAT) was developed and validated for use in the general population and consists of 21 questions designed to assess knowledge of general AFib information, including risk

factors, detection, prevention, and management (Jatau et al., 2020). For each item, one of three responses could be selected: "True," "False," or "I don't know." Correct responses scored '1' while an incorrect or "I don't know" response scored '0' with a maximum score of 21 (see Table 1). The AFKAT's psychometric properties (construct validity, reliability, readability, and difficulty index), were all tested in a validation study (Jatau et al., 2020).

Survey Questionnaire

The survey questionnaire consisted of 29 questions with seven demographic questions, 21 from the AFKAT, and concluded with one previously piloted question from Reading et al. (2017), which asked respondents: "Have you ever been told by a doctor or other health professional that you have a heart rhythm problem called atrial fibrillation or atrial flutter? Atrial fibrillation and atrial flutter cause an irregular heartbeat." Questionnaire access was given through a link and QR code. Before the survey, participants were presented with information about the research scope and required to complete an informed consent. Participants had the option to terminate their study involvement by closing the link. Ethical approval was obtained from the Conjoint Health Research Ethics Board (REB22-1719), and the study adhered to the guidelines established by the Declaration of Helsinki.

Data Analysis

Completed responses were exported from the Qualtrics server to an encrypted Excel file hosted on the University of Calgary's server. Following this the data was cleaned to remove any ineligible responses as per our inclusion criteria. All demographic data and AFib knowledge scores are reported descriptively (means; standard deviations, \pm). Differences between knowledge scores were analyzed using one-way analysis of variance (ANOVA), and a p-value of 0.05 was considered statistically significant. All analyses were conducted using SPSS V.29 program (SPSS Inc., Chicago, IL, USA).

RESULTS

Characteristics of the Sample

All participants self-identified as females, 96% were Caucasian (50/52), 87% were over the age of 40 (45/52), and 46% were university-educated (24/52) (see Table 2). Most athletes (79%) were curlers (41/52) and had competed at an international level (62%, 32/52) (see Table 3). Eight participants self-reported that they had been previously diagnosed with AFib and their scores ranged from 4-20 with a mean score of 15.13 ± 4.94 .

General Knowledge about AFib

A high proportion of participants were able to recognize that individuals suffering from AFib can still maintain an active lifestyle (88%, 46/52), AFib can occur at any age (88%, 46/52), episodes of AFib can be recurrent (87%, 45/52),

Table 1. Atrial Fibrillation Knowledge Assessment Tool (AFKAT) by Jatau et al., 2020

Item	Question	Answer
1	Atrial fibrillation is a medical condition where the heart beats slower than normal.	False
2	Atrial fibrillation may cause blood clots in the heart.	True
3	Episodes of atrial fibrillation are predictable.	False
4	People with atrial fibrillation can still have an active life.	True
5	Atrial fibrillation can only be treated with surgery.	False
6	Episodes of atrial fibrillation can be recurrent.	True
7	Early diagnosis and management of atrial fibrillation can prevent stroke.	True
8	Low blood pressure increases the risk of developing atrial fibrillation.	False
9	Atrial fibrillation significantly increases the risk of stroke.	True
10	Atrial fibrillation occurs only in people with prior signs of heart disease.	False
11	Shortness of breath and fainting can be potential symptoms of atrial fibrillation.	True
12	Atrial fibrillation occurs only in old age.	False
13	Someone could have atrial fibrillation without having any symptoms.	True
14	Symptoms of atrial fibrillation may be occasional, persistent, or permanent.	True
15	Atrial fibrillation usually has major psychological effects on people's lives.	False
16	The risk of developing atrial fibrillation can be reduced with lifestyle changes.	True
17	Atrial fibrillation can be detected by checking the regularity of the pulse.	True
18	Screening for atrial fibrillation is safe.	True
19	Once present, atrial fibrillation is always a lifelong condition.	False
20	Atrial fibrillation can be treated with medications.	True
21	Anticoagulants ("blood thinners") are often used to reduce the risk of stroke in people with atrial fibrillation.	True

and that screening for AFib is safe (81%, 42/52). However, many participants could not identify potential complications of AFib, such as AFib significantly increasing the risk of stroke (42%, 22/52) and that AFib may cause blood clots in the heart (54%, 28/52). Over three-fourths of participants believed that low blood pressure increases the risk of developing AFib (79%, 41/52), and only two-thirds knew that AFib could be symptomless (63%, 33/52). Almost half of the participants were unaware that AFib could be treated without surgery (42%, 22/52), and about two-thirds of participants

Table 2. Participant demographics by age, ethnicity, and education (n=53)

	years	n	%
Age	30-39	7	13.0
	40-59	9	16.7
	50-59	19	35.2
	60-69	16	29.6
	70 or older	2	3.7
Ethnic Background	Asian - Eastern	1	1.9
	Native-American	1	1.9
	White/Caucasian	51	96.2
Highest Level of Education Completed	Some Secondary	2	3.8
	Completed Secondary	6	11.3
	Vocational or Similar	6	11.3
	Some University	14	26.4
	Bachelor's degree	16	30.2
Graduate or Professional Degree	9	17.0	

Table 3. Participant's sport and level of competition (n=53)

	n	%
Sport		
Artistic Swimming	1	1.9
Bobsleigh	2	3.8
Curling	40	75.5
Field Hockey	1	1.9
Multisport*	3	5.7
Powerlifting	1	1.9
Soccer	2	3.8
Speed Skating	1	1.9
Synchronized Skating	1	1.9
Triathlon	1	1.9
Competition Level Reached		
International	32	60.4
National	20	37.7
Provincial	1	1.9

*Individuals who listed several sport combinations: curling/artistic swimming; curling/figure skating; bodybuilding/Track and Field/Gymnastics

did not know that AFib could be detected by checking the regularity of the pulse (62%, 32/52). More than three-fourths of participants believed that AFib caused major psychological effects in life (77%, 40/52), and many thought that once present, AFib became a lifelong condition (85%, 44/52).

Knowledge about AFib Questionnaire Scores by Demographic Characteristics

The AFib knowledge questionnaire score had a maximum score of 21, and the mean score was 12.63 ± 5.79 , with a wide range from 0-21 (Figure 1). We observed a

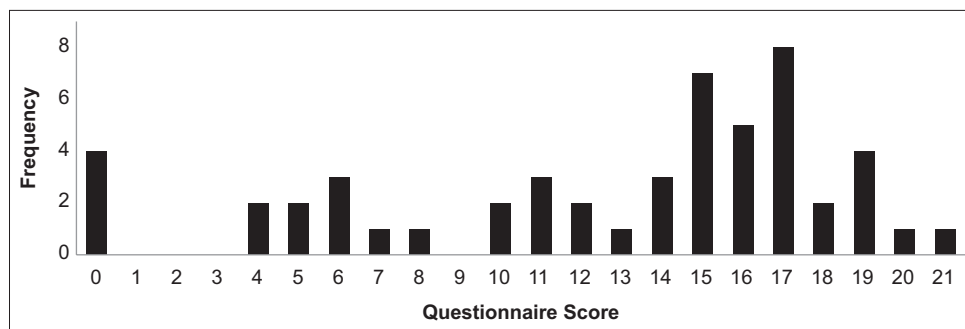


Figure 1. Frequency of Participant's Atrial Fibrillation Knowledge Scores ($n=52$; 12.53 ± 5.79)

higher mean AFib knowledge questionnaire score in international-level athletes ($14.22, \pm 4.38$) than in national-level athletes (10.10 ± 6.91) and this was significantly different ($F(208,1) = 6.954, p = 0.011$). No other significant differences were observed between mean AFib knowledge level and age, ethnicity, education level, sports discipline, or presence of an AFib diagnosis.

DISCUSSION

In this study, we identified AFib knowledge deficits held by high-performance Canadian female athletes who may be at heightened risk of developing this condition. Our results demonstrate, that regardless of whether athletes had previously received an AFib diagnosis or not, they had limited general knowledge about AFib. Age, ethnicity, education level, and sports discipline did not significantly influence AFib knowledge scores. However, the level of competition emerged as a key determinant, with athletes competing at the international-level exhibiting higher knowledge scores (14.22 ± 4.38) than those who had competed at a national-level (10.10 ± 6.91) ($p = 0.011$). This difference between athlete competition levels underscores the need for tailored educational interventions, especially for national-level athletes, that address areas where knowledge gaps persist, such as AFib risk factors, complications, screening methods, and treatment options.

The previous study that validated the AFKAT's ability to assess general AF knowledge observed a mean percentage score of 53.4 ± 27.7 in the public population (Jatau Abubakar et al., 2020). In comparison, participants in our study achieved a mean percentage score of 60.1 ± 27.6 (mean/total score $\times 100$), suggesting that our high-performance female athletes possessed a more comprehensive general understanding of AFib when compared to the public.

Nearly half (42%, 22/52) of our participants, however, were unaware that AFib was associated with an increased risk of ischemic stroke. Individuals with AFib are approximately five times more likely to experience a stroke than those without the condition, and one-third of cardiac arrhythmia hospitalizations are attributable to AFib-related complications (Pereira et al., 2020). Increased knowledge of this association between AFib and stroke may help individuals take proactive steps to reduce their risk by engaging in early screening measures (Jones et al., 2020).

Moreover, 37% (19/52) of our participants were unaware that AFib could be symptomless. Even without symptoms,

untreated AFib can result in stroke, underscoring the importance of educating those at risk about AFib-related complications (Jatau et al., 2020). Previous studies have found that individuals without palpitation symptoms and/or asymptomatic new-onset AFib have a 3.5-fold and 2.7-fold higher risk of cerebrovascular events than those with palpitations (Siontis et al., 2016). Therefore, highlighting that AFib can be asymptomatic within educational interventions could also encourage at-risk individuals to pursue routine screenings for timely diagnosis and suitable treatment.

While 81% (42/52) of our participants recognized that AFib screening measures were safe, 62% (32/52) were unaware that AFib could be detected through pulse regularity checks. Screening methods, including pulse monitoring, electrocardiograms (ECGs), and mobile health devices which are known to be non-invasive and generally safe (Jones et al., 2020). By detecting AFib early, individuals can receive appropriate treatment and make lifestyle changes to reduce their risk of complications (Jatau et al., 2020). Promoting the safety and ease of these screening measures may motivate individuals to undergo regular screenings, facilitating AFib identification and monitoring over time.

Approximately 42% (22/52) of our participants were unaware that other measures beyond surgery can treat AFib. Educating individuals at risk about these alternatives can ease concerns that may hinder timely diagnoses. While surgery is necessary for some AFib cases, non-surgical options, such as medications and catheter ablation, are also available (Stergiou & Duncan, 2018). Empowering at-risk individuals with knowledge about such treatments encourages early engagement with healthcare providers where personalized treatment plans can be made according to patient preferences and needs. Prioritizing educational interventions focusing on screening and treatment measures can thus help these individuals make informed choices regarding their care.

Our study's findings shed light on specific areas of AFib knowledge where athletes demonstrated less proficiency. Topics related to AFib risk factors, complications, screening methods, and treatment options were identified as areas requiring heightened attention in future educational initiatives. A strength of these results is that they bring awareness and underscore the necessity for a comprehensive educational campaign related to AFib in female athletes. These campaigns should be designed to bridge the knowledge gaps and ensure that athletes possess the health literacy and skills to promptly seek treatment for AFib signs and symptoms.

Limitations

Our study's limited participant demographic diversity reduces the generalizability of our findings, specifically to younger athletes. Most of our female athletes were Caucasian, aged over 40, and university-educated, with a background in curling. These demographics align with those of the Canadian curling population, where approximately 80% are Canadian-born, 51% are over 40, and 38% have university degrees or higher (Potwarka, 2020).

The Scotties Tournament of Hearts (<https://www.curling.ca/2023scotties/>), a Canadian women's curling championship, coincided with our study recruitment. Simultaneously, a cardiology commercial was aired on February 1st 2023, followed by a report related to heart disease (Wright, 2023) encouraging discussions with cardiologists about heart conditions. This could have heightened awareness of cardiovascular issues among individuals with curling backgrounds, potentially impacting survey responses.

CONCLUSIONS

This study aimed to evaluate the degree of AFib-related knowledge in high-performance Canadian female athletes over 30 years of age. Our findings suggest that general knowledge of AFib in this athlete population is varied, showcasing that there is an opportunity to improve awareness of AFib within this population. A significant difference between mean AFib knowledge survey scores and competition levels was observed, suggesting that educational interventions at the national sporting level will have the most impact on improving knowledge and awareness of AFib in female athletes. Our results are timely as a recent study by Drca et al., (2023), observed that elite female endurance athletes are at an increased risk of AFib when compared to the general population. Also, educational programs aimed at the athlete's life-long health are lacking in Canada as identified by Di Ciacca et al., (2021) in a recent cross-sectional study investigating retired high-performance female athletes' health. Therefore, to help decrease the knowledge gap in elite female athlete health, educational interventions on cardiovascular health should include AFib knowledge to inform them of the risk factors, types and variety of AFib symptoms, screening, and treatments available.

AUTHOR CONTRIBUTIONS

Authors AM and PKDB contributed to the conceptual design of the study. Author AM collected the data, performed the statistical analysis and wrote the first draft. PKDB wrote the second draft, and both authors read and approved the submission.

ETHICS APPROVAL

The study approved was obtained from the Conjoint Health Research Ethics Board (REB22-1719), and the study adhered to the guidelines established by the Declaration of Helsinki by the Human Research Ethics Committees.

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