Prevalence and risk factors for atrial fibrillation and its anticoagulant requirement in adults aged ≥40 in Jimma Town, Southwest Ethiopia: A community based cross-sectional study

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ABSTRACT

Background: There is no information on the prevalence and incidence of atrial fibrillation in Ethiopia. We aimed to investigate the prevalence, risk factors and anticoagulant requirements of atrial fibrillation in an elderly Jimma population.

Methods: In a community-based cross-sectional study in 634 adult (≥40 years) Jimma population, we performed cardiovascular health examinations including a 12-lead electrocardiogram to estimate AF prevalence. A standardized questionnaire was used to collect information on medical history, lifestyle and use of medications. Stroke risk stratification was done using CHA$_2$DS$_2$-VASc score. We used logistic regressions to determine the potential risk factors of AF.

Results: The overall prevalence of AF was 4.3%. AF was associated with sex, current smoking, hypertension and BMI. Nineteen out of twenty seven participants with AF were in need of anticoagulation to prevent risk of stroke.

Conclusion: The prevalence of AF is high and common risk factors were sex, current smoking, hypertension, and higher BMI in this cohort. More than two-third of study participants with AF were at higher need of oral anticoagulants.

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1. Introduction

Atrial fibrillation (AF) is the commonest arrhythmia associated with a significant cardiovascular disease burden, with increased risk of a number of co-morbidities; of particular concern is the five-fold increased risk of stroke [1]. AF is often identified by the clinical observation of an irregular pulse; the suspicion must always be confirmed with a resting electrocardiogram (ECG) [2].

The principal pathophysiological mechanisms can be divided into electrophysiological and structural abnormalities [3]. Interestingly, AF is a self-perpetuating arrhythmia, inducing remodeling changes that are in themselves a cause of AF [3,4].

It has been shown that AF is probably triggered by rapidly firing focal sources. Moreover, atrial interstitial fibrosis has also been shown to increase AF vulnerability by creating a substrate for intra-atrial re-entry circuit (intracellular scar) that promotes AF. Atrial interstitial fibrosis is increased with age in humans and in congestive heart failure [4].

AF can be symptomatic with tachycardia, but is usually asymptomatic or mildly symptomatic and even up to 75% of cases are silent. AF can be permanent, but in the beginning is often paroxysmal. That explains why the detection rate of AF is low in the clinical practice and why the prevalence of atrial fibrillation varies between studies [5,6].

Data from the West reveal that the incidence and prevalence of AF are higher in men as compared to females with reported male: female rates of appx 1.1% vs 0.8%. In both Framingham Heart Study and Atherosclerosis Risk in Communities Study, men had a 1.5-fold greater risk of developing AF than women and the lifetime risk of developing AF after age of 40 in the Framingham cohort was reported to be 26% for men and 23% for women [7].

The Framingham Heart Study and other investigations have identified advancing age, male sex, hypertension, diabetes mellitus, obesity, heart failure, valve disease, myocardial infarction (MI), smoking, alcohol consumption, and khat chewing as major risk factors for AF [1,8–33].

Apart from its effect on cardiac function, AF is a major risk factor for stroke and systemic embolization, and this risk is increasing significantly with the aging of the population, with up to 5% of those 70 years or older having this condition [34,35]. AF increases the risk of stroke by approximately 5-fold and doubles the rate of mortality in patients with concomitant heart disease compared with age-matched controls. It has been shown that there is a steep age-related increase in the risk of stroke in patients with AF, ranging from 1.5% at age 50 to 59 years to 23.5% at age 80 to 89 years [34,36].

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The global prevalence of AF is estimated to be 0.47%, but there is significant regional variation [37]. However, most of the available data on prevalence of AF is from studies performed in North America and Western Europe. There is a significant lack of epidemiological information regarding AF in the low/middle-income nations, including Ethiopia. Prevalence studies are important in estimating the population burden of the disease and are instrumental in developing effective public health policies [38].

Stroke occurring in patients with AF is associated with increased mortality and morbidity, severe disability, greater rate of stroke recurrence, and longer hospitalization [39]. CHADS$_2$ (Congestive heart failure, Hypertension, Age ≥75 years, Diabetes, and prior Stroke or transient ischemic attack (TIA) [doubled]) [40], and CHA$_2$DS$_2$-VASc (Congestive heart failure, Hypertension, Age ≥75 years [doubled], Diabetes, prior Stroke or TIA [doubled] e Vascular disease, Age 65–74 years, and Sex category [female]) [41] are 2 well-validated risk-stratification scores for predicting stroke in patients with atrial fibrillation. CHA$_2$DS$_2$-VASc score was recommended for risk assessment of stroke by the 2010 European Society of Cardiology, and the 2014 American Heart Association/American College of Cardiology/Heart Rhythm Society guidelines for the management of patients with atrial fibrillation [42–44].

A community-based study on the prevalence of AF has never been carried out in a multi-ethnic country such as Ethiopia. Ethiopia is the second most populous country in Africa with a population of over 100 million. Being a sub-Saharan country it is facing the double burden of diseases because of epidemiological transition. Predisposing factors for cardiovascular disease and sudden death due to cardiovascular disorders are rampant in Ethiopia. Therefore, it is important to determine the prevalence of AF and its associated risk factors in the country.

2. Materials and methods

2.1. Study population

We conducted a cross-sectional study on adults aged 40 and above living in Jimma town, Southwest Ethiopia from May to August 2017. Ethiopia is located at the horn of Africa and has a population of 106. It follows three-tier health care system which consists of tertiary level (specialized hospitals: serving 3.5–5 million people), Secondary level (General hospitals: serving 1–1.5 million people), and Primary level (primary hospital: serving 60,000–100,000 peoples; Health center: serving 15,000–25,000 people; and Health post: serving 3000–5, 000 people). In the country one medical doctor provide service for about 28, 867 people. Jimma Town is located 352 km away from the capital Addis Ababa, Southwest of Ethiopia. It has a population of over 200,000 and it has one specialized hospital which provides healthcare service for over 15 million people from nearby regions.

Sample size was determined using single population proportion formula. Since, no previous similar studies were done in Ethiopia; the p-value was taken as 0.5 and margin of error 0.05. A 10% non-response rate was used. After design effect of 1.5, extrapolated from WHO estimate for risk factor assessment studies, we get sample size of 634.

Multi-stage sampling technique was utilized. Initially six Kebeles (lowest administrative unit in Ethiopia) were selected from the seventeen Kebeles of the town by simple random sampling, then the total sample size of 634 were distributed to the six Kebeles employing proportional to size allocation to the Kebeles. A systematic sampling technique was undertaken to identify the study households from each Kebele. The sample sizes were divided proportionally to the respective Kebeles. An individual from the household was then chosen with a lottery method.

The study was approved by the Ethics Committee of Jimma University in Jimma, Ethiopia, and all procedures were performed in accordance with its ethical standards. Written consent was obtained from all participants after they had been informed of the study's objectives, and confidentiality safeguards for personal information. If the participants were illiterate, we obtained written informed consent from their proxies.

2.2. Data collection and measurement

Data were collected during a single household visit by trained General practitioners and nurses using a standard questionnaire in a face-to-face interview. All potential investigators received training on the purpose of the study, how to administer the questionnaire, the standard methods of measurement, the importance of standardization, and study procedures. Investigators were under supervision during data collection.

The questionnaire assessed data on socio-demographic characteristics, lifestyle risk factors (smoking, alcohol drinking, khat chewing), and family history of AF and related chronic diseases.

Diabetes mellitus was diagnosed if the subjects had a fasting glucose level of or higher (≥126 mg/dL) or was taking insulin or an oral hypoglycemic agent at the current examination [45]. Hypertension was defined for each examination as a systolic blood pressure of at least 140 mm Hg or a diastolic blood pressure of at least 90 mm Hg on each of two readings or the use of antihypertensive medication [46].

Weight and height were measured using stadiometer (TANITA 380, Tokyo, Japan) to the nearest 0.1 kg and 0.1 cm, respectively, with the participants in lightweight clothing and without shoes. The body mass index (BMI) was calculated as weight in kilograms divided by the square of the height in meters.

Waist circumference was measured at the horizontal plane that corresponds with the mid-point between the anterior superior iliac spine and the lower costal margin at the mid-clavicular line using stretch resistant tape-meter. We used the European cut off to interpret the waist circumference measurements for the Sub-Saharan African People as per the WHO and International Diabetes Federation recommendations. According to the above guidelines the range of abnormal waist circumference of male and female are ≥94 cm and ≥80 cm, respectively [47].

Twelve-lead ECGs (ECG1200G, YSIP-155, Beijing, China) (resting, 10 s) were performed on all participants by well-trained General practitioners with a standardization of 1 mV = 10 mm and paper speed of 25 mm/s. ECG-based AF diagnoses were reviewed by at least two independent cardiologists. ECG electrode explores electrical impulse generated through extracellular fluid; we first have participants lie supine on examination bed calmly and then clean the subsequent anatomical location for each electrode with alcohol, cut if nonconductive tissue such as hair(in male participants) were there and then applied cardio-cream to enhance conductivity; electrodes were placed accordingly and participants were asked to close his/her eyes to avoid disturbances and eventually after clear waveform recruited the electrocardiogram result was printed. Our ECG machine is rechargeable and once recharged it can record for >10 h if continually used or for couple of days otherwise.

2.3. Statistical analysis

Data entered into EPI data manager software version 4.0.2 (Odense, Denmark) and were exported to a computer software package SPSS (V.21; SPSS, IBM, Chicago, Illinois, USA) for statistical analysis. Categorical variables were described with frequency and percentage. Binary and multivariable logistic analyses were used to compare AF and associated factors. P value ≤0.05 was considered to indicate statistical significance. Bivariate analyses were done and all covariate variables which had association with the outcome variables at P-value of 0.25 were selected for multivariate analyses. Multivariable logistic regression models were used to isolate independent predictors of AF. Normality of continuous variables was checked using graphic methods (Histograms with normality curves and QQ-plots) and models were selected depending on the type of dependent variable (Logistic regression for binary variable) and multicollinearity was checked and Hosmer Lemeshaw test was done for assessing goodness of model fitness.

3. Result

3.1. Socio-demographic characteristics of the participants

A total of 634 participants took part in this study out of whom 360 (56.8%) were females while 274 (43.2%) were males.

The mean age of the participants was 63.3 ± 11.9. Majority of study participants were in age group of 60–69 years. Regarding the ethnicity of the participants, majority of them were Oromo 295 (46.5%) followed by Amhara 108 (17.0%). Three hundred twenty seven (51.6%) participants were Orthodox Christians, 272 (42.9%) were Muslims and the remaining 5.5% were others.

Concerning the marital status, 351 (55.4%) of the participants were married, and 205 (32.3%) were widowed/widower and majority of the participants (40.5%) were unable to read and write whereas 231 (36.4%) had got primary education. About 208 (32.8%) of the study participants were house wives followed by pensioner, 84 (13.2%) (Table 1).

3.2. Prevalence of atrial fibrillation

The prevalence of atrial fibrillation among the study participants was found to be 4.3% (27/634). The prevalence rose steeply with advancing age in the study participants. It was 5.1% (4/78) in people aged 40–49 year where as 6.9% (4/58) in those whose age was ≥80 yr. The mean age of individuals with AF was approximately 62.6 yr. There was no significant difference in prevalence of AF between men and women (p = 0.145) (Table 2).

Table 1
Socio-demographic characteristics of the participants, Jimma town, May to July 2017.

Characteristics	Frequency	Percent
Sex		
Male	274	43.2
Female	360	56.8
Age		
40–49	78	12.3
50–59	133	21.0
60–69	199	31.4
70–79	166	26.2
80+	58	9.1
Ethnicity		
Oromo	295	46.5
Amhara	108	17.0
*Others	231	36.4
Religion		
Orthodox	327	51.6
Protestant	28	4.4
Muslim	272	42.9
°Others	7	11
Marital status		
Married	351	55.4
Widowed/widower	205	32.3
**Others	78	12.3
Educational status		
Illiterate	257	40.5
Primary (1–8)	231	36.4
Secondary (9–12)	98	15.5
Diploma and above	48	7.6
Occupation		
Employee	212	33.4
Housewife	208	32.8
^Others	214	33.8
Income		
Low income	518	81.7
High income	51	8.0

*Woliata, Kafa, Dawuro, Gurage, Silte, Yem etc. Catholic, J. witness, Waqefata;**single/unmarried, separated, Divorced; ^None, Pensioners.

Table 2
Prevalence of atrial fibrillation according to age group and sex.

Age groups (yr)	Male (%)	Female (%)	Total (%)
40–49	2 (8.3%)	2 (3.7%)	4 (0.6%)
50–59	1 (1.8%)	5 (6.6%)	6 (0.9%)
60–69	2 (2.1%)	6 (5.9%)	8 (0.1%)
70–79	3 (4.0%)	2 (2.2%)	5 (0.7%)
≥80	0 (0.0%)	4 (10.8%)	4 (0.6%)
Total	8 (2.9%)	19 (5.3%)	27 (4.3%)

% = number of atrial fibrillation/number of participants.

3.3. Factors associated with AF

Bivariate analysis indicated that hypertension (COR = 2.42; 95% C.I = 1.103–5.301; P = 0.028) and study participants who had high risk for OSA (COR = 2.86; 95% C.I = 1.195–6.879; P = 0.018) were independently associated with AF; whereas sex, age, occupation, marital status, current smoking, current drinking, khat chewing, diabetes, prior MI, history of stroke and higher body mass index were not associated with AF (Table 3).

A multivariate logistic regression analysis revealed that sex, current smoking, hypertension and BMI were independent risk factors for AF (P < 0.05) (Table 4). The strongest risk factor for AF was being male with an odds ratio of 2.71; 95% C.I = 1.025–7.173 and P = 0.04.

3.4. Stroke risk stratification scores of AF cases

Stroke risk stratification in participants with AF was done using validated CHA_2DS_2-VASc score which includes: congestive heart failure, Age ≥75, DM, Stroke, Vascular diseases, Age from 65 to 74 years and

Table 3
Bivariate analysis of selected risk factors for atrial fibrillation.

Variables		AF		COR (95% C.I)	P value
		Yes	No		
Sex	Female	19	341	1	
	Male	8	266	1.853 [0.799, 4.298]	0.151
Age	40–49	4	74	1	
	50–59	6	127	0.874 [0.239, 3.198]	0.839
	60–69	8	191	0.775 [0.227, 2.651]	0.684
	70–79	5	161	0.575 [0.150, 2.201]	0.419
	≥80	4	54	1.370 [0.328, 5.724]	0.666
Occupation	Employee	9	203	0.786 [0.287, 2.150]	0.638
	Housewife	7	201	1.222 [0.496, 3.013]	0.663
	Others	11	203	1	
Marital status	Married	10	341	0.428 [0.142, 1.29]	0.132
	Widowed/wer	12	193	0.908 [0.309, 2.67]	0.860
	Others	5	73	1	
Current smoker	Yes	4	44	2.225 [0.737, 6.720]	0.156
	No	23	563	1	
Current drinker	Yes	7	207	0.676 [0.281, 1.626]	0.382
	No	20	400	1	
Khat chewing	Yes	7	170	0.900 [0.374, 2.166]	0.814
	No	20	437	1	
HTN	Yes	16	228	2.42 [1.103, 5.301]	0.028*
	No	11	379	1	
DM	Yes	5	74	1.64 [0.602, 4.454]	0.33
	No	22	533	1	
OSA	Low risk for OSA	7	304	1	0.018*
	High risk OSA	20	303	2.86 [1.195, 6.879]	
Previous MI	Yes	3	82	0.8 [0.236, 2.718]	0.72
	No	24	525	1	
History of stroke	Yes	1	25	0.895 [0.117, 6.86]	0.915
	No	26	582	1	
BMI	<18.5	4	81	1	
	18.5–24.9	10	346	0.441 [0.134, 1.45]	0.178
	25–29.9	8	134	0.910 [0.264, 3.14]	0.882
	≥30	5	66	1.155 [0.296, 4.50]	0.835

* Candidate variables for multivariate logistic regression.

Table 4
Multivariable logistic regression model predicting AF among study participants in Jimma Town, 2017.

Variables	AOR	95% C.I	P value
Intercept			0.008
Sex	2.71	1.025, 7.173	0.04
Current smoker	0.25	0.72, 0.84	0.02
Hypertension	0.41	0.17, 0.93	0.03
BMI	1.04	1.000, 1.071	0.04

female sex category. All components have score of 1 each except age ≥75 and stroke which have score of 2 each. Accordingly, CHA_2DS_2-VASc score of ≥2 in male and CHA_2DS_2-VASc score ≥3 in female mandates for start of anti-coagulations. So in current study nineteen out of twenty seven participants with AF have to take anticoagulation to prevent risk of ischemic attack (Fig. 1).

4. Discussions

This community-based study confirmed a 4.3% prevalence of AF in an adult urban Jimma population. This result is in line with a study conducted in an urban South African community which reported a 4.6% AF prevalence [48].

In contrary to the current study, the prevalence of AF in Ivory Coast, and Senegal were 5.5% and 5.4%, respectively [49]. The difference in the findings might be due to study setting. The studies in Ivory Coast and Senegal were hospital based where as our study was community based. Similarly, a study done in India found a 5.1% prevalence of AF; which is higher than our finding. This discrepancy might be attributed to the difference in the screening tool used to detect AF and their sample size is by half lower than our study [50].

A strikingly lower prevalence rate of AF was reported in a Kenyan and a Tanzanian study in which the prevalence of AF among the participants of both studies was 0.7% [51,52]. This low prevalence might be due to the patients have been taken medication for underlying cause. Yet, a recent nationwide, retrospective, observational Italian study involving 233 general practitioners and screening almost 300,000 patients representative of the population, the prevalence of AF was 2.0% [53].

In this study, sex, current smoking, hypertension and BMI were independent risk factors for AF. However, khat chewing, diabetes, prior MI, history of stroke, and occupation were not associated with an increasing risk of AF. The results of our study are consistent with previous reports [15,54,55].

In this study, men were found to be two times at higher risk for AF than women. Other studies have also reported that men are more prone to the development of atrial fibrillation [56,57]. In the Framingham Heart Study, men were found to have a 1.5-fold higher risk of developing atrial fibrillation compared with women [58]. Our result indicated that current cigarette smokers were 25% more likely to develop AF than non-smokers. Similar finding was reported by Alanna M. et al. that smoking was associated with the incidence of AF, with more than a 2-fold increased risk of AF attributed to current smoking [15,59].

In the present study hypertensives were 0.41 times more likely to have AF. Similar study done in Malaysia reported significant association between AF and hypertension [60] and in a study done to determine prevalence of AF in patient with HTN it found to be 3.46%, indicating hypertension as independent predictor for commonest sustained arrhythmia [61]. Hypertension has two major consequences on the heart: left ventricular hypertrophy, and morphological and functional alterations of the coronary macro- and micro-vessels. These two cardiac modifications are responsible for 3 types of complications: myocardial ischemia, left ventricular dysfunction and electrical instability, which are involved in the pathogenesis of atrial and ventricular arrhythmias in hypertensive patients [62].

The finding of the current study has indicated that study participants whose body mass index were greater than or equal to thirty were at higher risk for AF than those who were normal weight. Obesity is one of the very few identified modifiable risk factors for the occurrence and progression of atrial fibrillation, and the mechanisms linking atrial fibrillation and obesity include: structural and electrophysiological atrial remodeling, metabolic factors, sympatho-vagal imbalance, clinical links (obstructive sleep apnea, cardiovascular comorbidities) and inflammation [63].

In current study we used CHA_2DS_2-VASc scoring to evaluate the anticoagulant requirement of study participants with atrial fibrillation. According to 'Ten Commandments' of 2016 European Society of Cardiology guideline for management of atrial fibrillation, stroke risk evaluation is based on the CHADS-VASc score. With a score ≥2 in male and ≥3 in female patients, anticoagulation for stroke prevention is clearly recommended, while in a score of 1 in males and 2 in females, anticoagulation should be considered. No antithrombotic therapy of any kind should be prescribed in patients with a CHADS-VASc score of 0 (males) or 1 (females) [64]. Accordingly nineteen out of twenty seven study participants with diagnosis of atrial fibrillation have CHA_2DS_2-VASc ≥2 so that they deserved anticoagulation for prevention of stroke.

This study had some limitations. First, it was cross-sectional and could only reflect the associations between risk factors and AF. Second, we didn't use Holter-monitor ECG so we may have missed paroxysmal AF and also echocardiography was not employed. Thus a large scale community based study using Holter-monitor and echocardiography is highly recommended.

5. Conclusion

In conclusion, there is a high prevalence of AF (4.3%) in adults living in Jimma Town. Male sex, current smoking, hypertension, and higher BMI were identified as independent risk factors for AF in this population. Early screening and management of modifiable risk factors are an important way out to mitigate the burden of the disease.

List of abbreviations

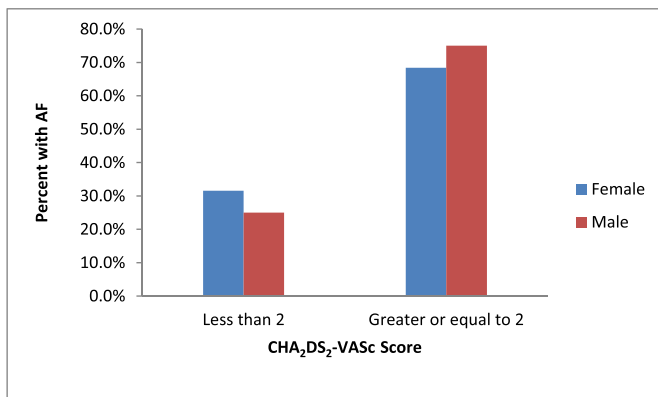|	
AF	atrial fibrillation
BMI	body mass index
DM	diabetes mellitus
ECG	electrocardiogram
HTN	hypertension
MI	myocardial infarction
OSA	obstructive sleep apnea

Fig. 1. Sex based distributions of atrial fibrillation by CHA2DS2-VASc Scoring system in study participants, Jimma Town, May to July 2017.

Acknowledgements

Conflicts of interest

The authors declare no conflict of interest in this work.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijcha.2019.02.003.

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