Community Based Study of Cerebrovascular Risk Factors in Tripoli-Libya (North Africa)

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Authors' contributions

This work was carried out in collaboration between all authors. Authors MKAS and EAF designed the study, wrote the protocol, authors MKAS and ZES wrote the first draft of the manuscript. Author TME managed the literature searches. Authors MKAS and OIB done the analyses of the study. All authors read and approved the final manuscript.

ABSTRACT

A stroke is the leading cause of adult mortality and disability. It is the second most common cause of death globally and may soon become the first cause of death worldwide. Among the most important risk factors for stroke are advanced age, hypertension, diabetes, previous stroke or transient ischemic attack. Hypertension and diabetes are the most important and frequent modifiable risk factors of stroke.

Objectives: Estimate the most important risk factors associated with stroke in African population by using CHADS2 method.

Study Design: Was community based descriptive cross-section.

Place and Duration of Study: North Africa (North west of Libya), among Individuals living in Tripoli area the capital, Duration of the study, five years from 1/1/2010 in to 31/12/2014.

Methodology: Data collected among 7497 individuals do not have atrial fibrillation (52.8% males & 48.2% females) which contained detailed histories (present, past, medical, hospital admission), available investigations, discharge letters and medical reports. Medical examinations was performed when necessary.

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Results: Among population screened (7497) over five years (from 2010 to 2014), the prevalence of diabetes was 39%, it was more among males than females (*P*=0.001). Hypertension was 38%, for most of age groups males have higher rate than females (*P*=0.041). Diabetes and hypertension increases with age groups over 40 (*P*<0.0001).

Congestive heart failure was 15.2% which increased with age (*P*<0.0001). Females have higher prevalence for 16-59 age groups and males dominated in over 60 years.

Transient ischemic attack (TIA) was 15%, males have higher TIA than females in all age groups (*P* <0.001) and increases with age (*P*<0.0001).

Prior Stroke (ischemic or hemorrhagic) prevalence was 9.7%, it was more among males than females (*P*=0.05) and increases with age over 40 (*P*<0.0001).

Conclusion: This Libyan study found stroke is a major public health problem in Africa, prevalence of stroke increases with age, and males are affected more than females for most of age groups. Diabetes, Hypertension, Congestive heart failure and previous history of embolic or transient ischemic attack are major risk factors that are associated with stroke.

Recommendation: To do another studies to measures stroke risk factors by using laboratory investigations, and other medical diagnostic procedures, consequently, to estimate the most accurate and true rates.

ABBREVIATIONS

CHF: Congestive Heart Failure; CDC: Centers of Disease Control; HT: Hypertension; TIA: TransientIschemic Attack; WHO: World Health Organization.

1. INTRODUCTION

Stroke is the second leading cause of death above the age of 60 years [1]. Every year, 15 million people worldwide suffer a stroke. Nearly six million die and other five million are left permanently disabled [1]. In the developing world, compared to the developed, stroke incidence is lower, even though the actual number of strokes is increasing, this because of complex risk factors including ageing, socio-culture and behavior environment [2].

The 2009 WHO World Health Report, found 359 000 stroke deaths (3% of all deaths) in Africa compared with almost 1.5 million (16% of all deaths) in Europe [3]. The cumulative incidence rate of cerebrovascular diseases in developed countries (Catalonia-Spain) per 100,000 population was 218 (95% CI, 214-221) in men and 127 (95% CI, 125-128) in women and this incidence rates in Catalonia are among the lowest in developed countries [4].

In the Middle East and North Africa stroke is increasingly becoming a major health problem, with expectation deaths from it will nearly double by 2030 [5]. In Libya, the incidence of stroke varies from 63 to 162 per 100,000 populations (depends on location inside Libya), males are

affected more than females [6]; and according to WHO 2014 report, 78% of deaths in Libya are due to non-communicable diseases, which include stroke [7]; and the mean age of stroke is within the sixth and seventh decade (varying from 58.5 to 63) [7].

Stroke risk factors are non-modifiable factors like sex (Men are 25% more likely to suffer strokes than women) [8], and increasing age; advanced age is one of the most significant stroke risk factors, 95% of strokes occur in people age 45 and older, and two-thirds of strokes occur in those who are over the age of 65 [9].

Modifiable risk factors such as hypertension, diabetes, obesity, smoking, and lack of exercise [10]. High blood pressure and diabetes mellitus are the most important modifiable risk factors of stroke [11]. Hypertension accounts for 35-50% of stroke risk [11]; as well as diabetic patient are at two to three times the risk of stroke compared with the general population [12]. According to the Libyan research institute report 2001; the percentage of people who have high blood pressure, diabetes, and obesity were 21.6%, 7.9% and 31% respectively [13]; and according to Center of Disease Control-World Health Organization report 2009 (done by Ministry of Health) the percentage of hypertensive people,

diabetic patients, and those with obesity have increased to 40%, 23.7%, and 63% respectively [14].

2. OBJECTIVE AND METHODOLOGY

2.1 Objectives

Estimate the most risk factors associated with stroke in Libyan population by using CHADS2 method.

2.2 Methodology

The study is community based descriptive, cross-sectional study, among Libyan individuals who live in Tripoli and surrounding areas.

2.2.1 Populations

Individuals who are 16 years old or above. Population sample: 7497 individuals do not have atrial fibrillation.

2.2.2 Area

Libya, Tripoli (the capital) & surrounding areas.

2.2.3 Time

Five year from 1/1/2010 to 31/12/2014.

CHADS2 Questionnaire originally used to assess stroke risk in patients with atrial fibrillation [15], but was adapted in this study to be used among population without AF as it had been used in other studies elsewhere [16].

Individuals were interviewed about risk factors of stroke using CHADS2 Questionnaire (showed in Table 1) as follows: Doctors in community and family medicine department at University of Tripoli collected data, took histories (present, past, medical, hospital admission), did medical examinations, checked of any available investigations, discharge letters and medical reports. Known cases of strokes or TIA had been established by medical diagnosis in the past by hospital specialists.

Statisticians were gathering and analyzing all data information using SPSS package version 17- USA. Data analysis by using T-test & *P value* was done to finalize the results of the study.

Table 1. Showing CHADS2 score questionnaire used in the study

Condition	
C:	Congestive heart failure
H:	Hypertension
A:	Age ≥70 & sex
D:	DM
S:	Prior Stroke or TIA

3. RESULTS

Using SPSS software independence sample t-test applied on age distribution of individuals screened for the whole study population (7497 individuals do not have atrial fibrillation), the mean age was 52.0, and the range of age was from 16 to >80 years old.

The age of participants was divided into 8 age groups (10 years interval within each group except for last group which include those who are ≥80 year old) as shown in Fig. 1 and Table 2.

Table 2. Shows age and sex structure of participants

Age	Sex		Total
	Male	**Female**	
10-19	81	62	143
20-29	453	479	932
30-39	534	500	1034
40-49	606	633	1239
50-59	650	667	1317
60-69	637	543	1180
70-79	641	448	1089
>80	279	284	563
Total	3881	3616	7497

From the whole participants males constitute 52.8% (3881) and females were 48.2% (3616) as shown in (Fig. 2); both age and sex structure in this study are similar to the result of Libyan census of 2010 (51% males & 49% females).

3.1 Diabetes Miletus (DM) as Risk Factor

The prevalence of DM among study population over five years was 39%, 54.1% among males and 45.9% among females. Males have higher prevalence rate among different age groups compared to females (*P*=0.001) Fig. 3.

Prevalence of DM increases with increase of age as shown in Fig. 3. In comparison to younger age

group, higher prevalence rate seen among those aged forties and older (*P*<0.0001).

3.2 Hypertension (HT) as Risk Factor

The prevalence of HT among our participants was 38%, among males and females were 50.2% and 49.8% respectively (*P*=0.041). Among different age groups, males have higher rate than females except for age intervals from 40-49, 50-59 and ≥80 where females have higher rate, shown in Fig. 4.

HT prevalence increases with increase of age, with higher rates among age groups over 40 (*P*<0.0001) Fig. 4.

3.3 Congestive Heart Failure (CHF) as Risk Factor

The prevalence of CHF among study population was 15.2%, 51.2% males and 48.8% females (*P* <0.05). Females have higher prevalence rate among different age groups compared to males except for age interval from 60 to 79 where males have higher rate as shown in Fig. 5.

Similar to diabetes mellitus and hypertension, prevalence of congestive heart failure increases

with age with higher prevalence rate over age of 40 (*P*<0.0001).

3.4 Transient Ischemic Attack (TIA)

The prevalence of TIA among study participants was 15%, 58.2% males and 41.8% females. Males have higher TIA rate than females in all age groups (*P* <0.001), shown in Fig. 6.

Like other study risk factors, the prevalence of TIA increases with increase of age; higher prevalence rate seen among those with age over 40 (*P*<0.0001) as shown in Fig. 6.

3.5 Prior Stroke (PS) (Embolic or Hemorrhagic)

Prior stroke prevalence rate was 9.7%, for males and females were 51.1% and 48.9% respectively (*P*=0.05). In comparison to males, females have higher prior stroke rate in age groups from 16 to 69 and males dominated in ages over 70 years old Fig. 7.

Similar to other risk factors, the prevalence of PS increases with increase of age, especially over age of forties (*P*<0.0001) as shown in Fig. 7.
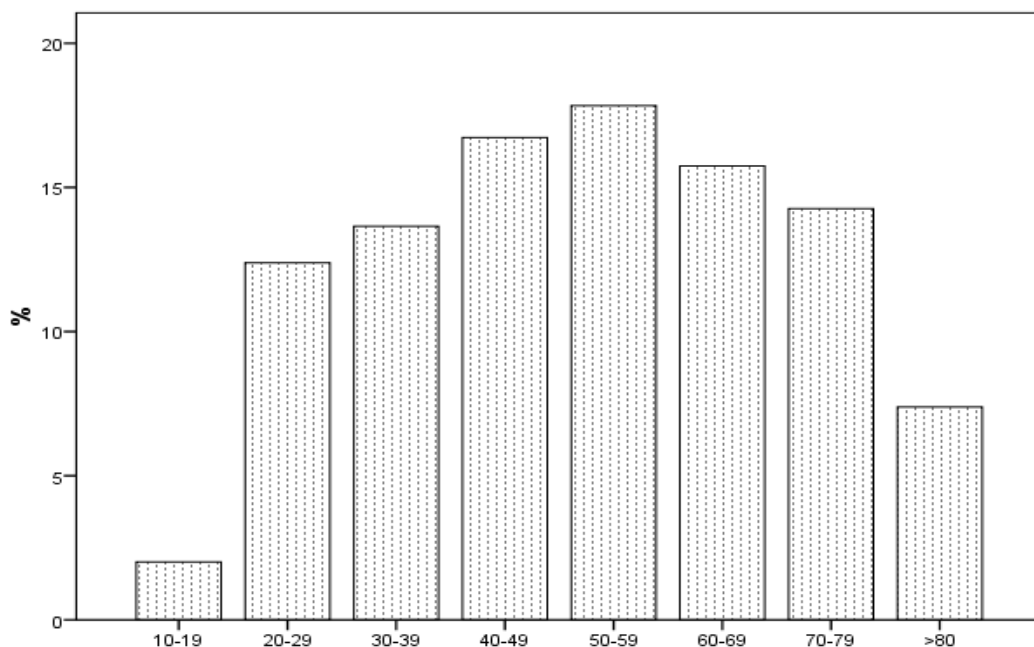

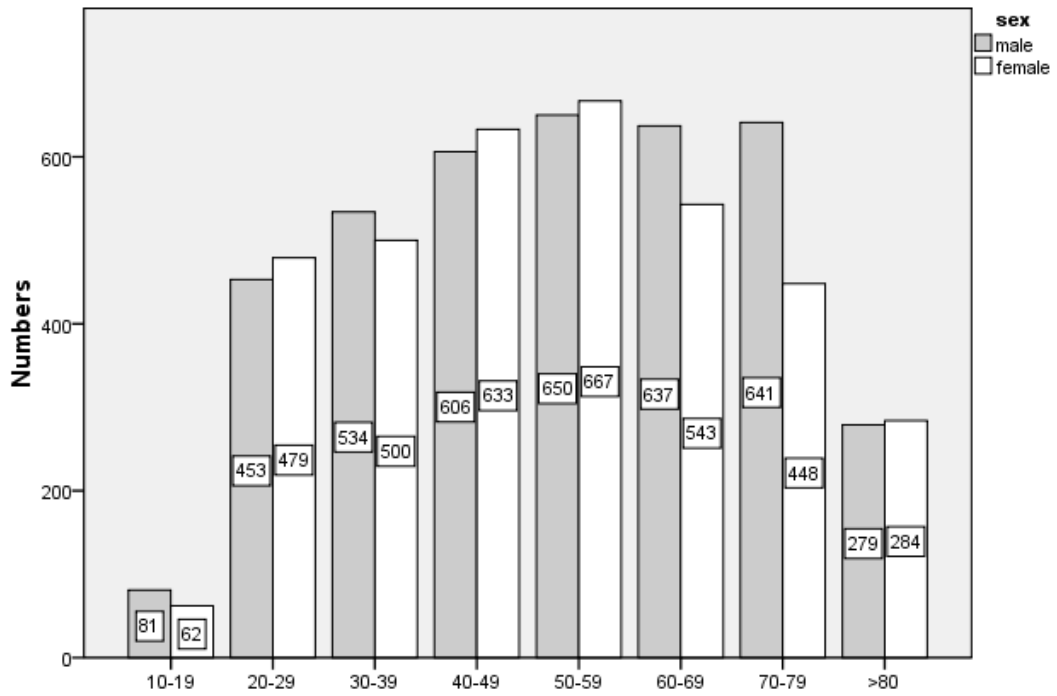**Fig. 1. Shows participants' age distribution**

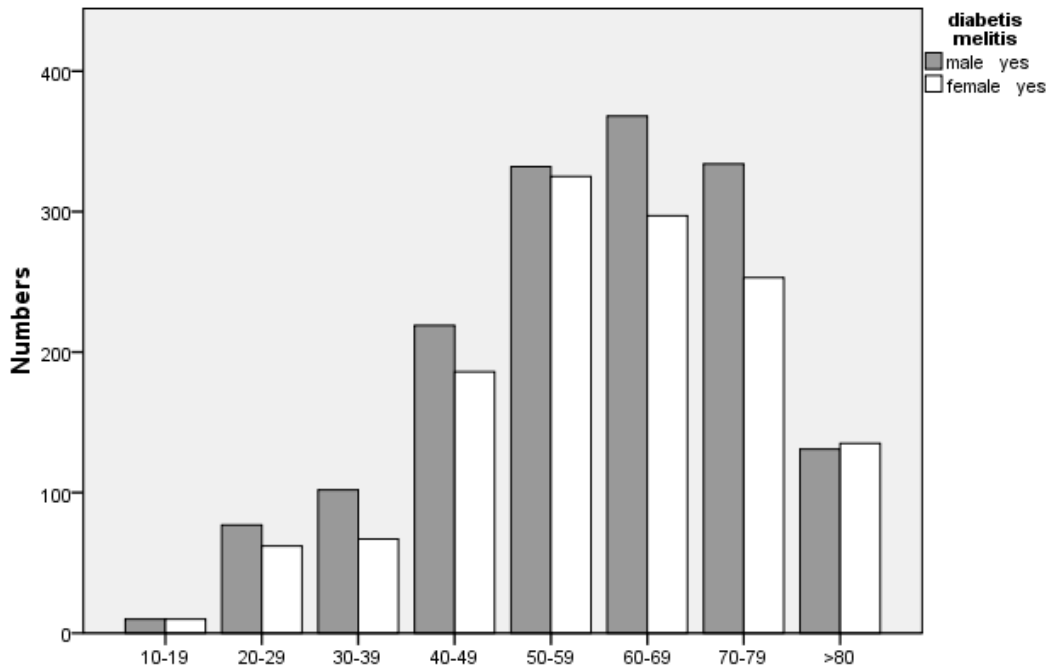**Fig. 2. Shows participants' age and sex structure**

Fig. 3. Shows diabetes mellitus distribution within different age groups for both males and females
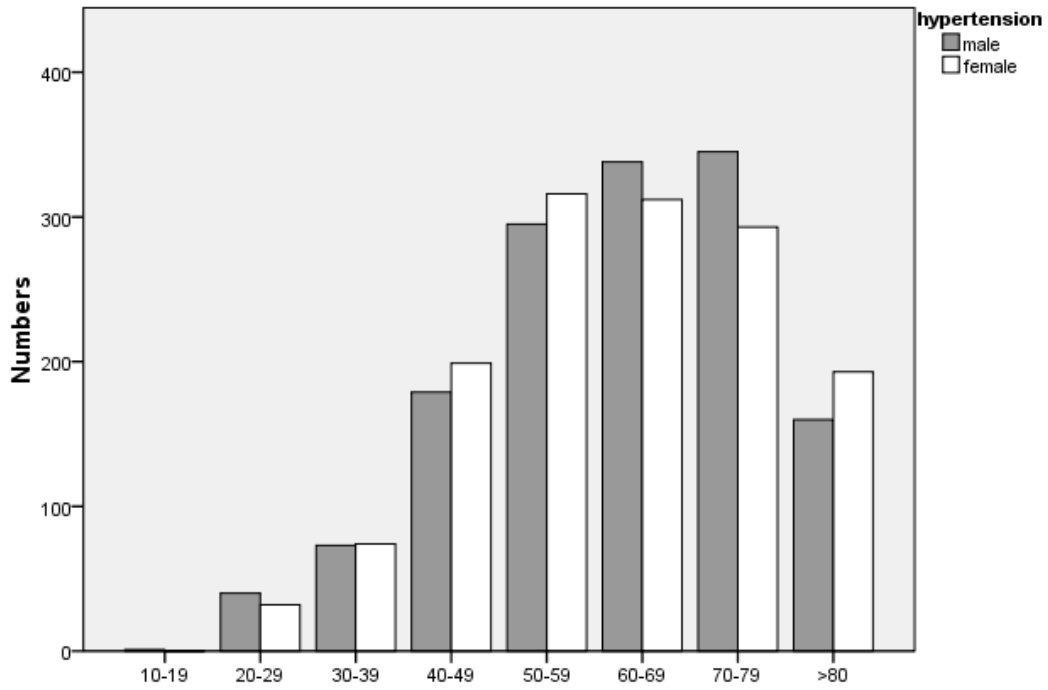
Fig. 4. Shows hypertension distribution among males, females and within different age groups
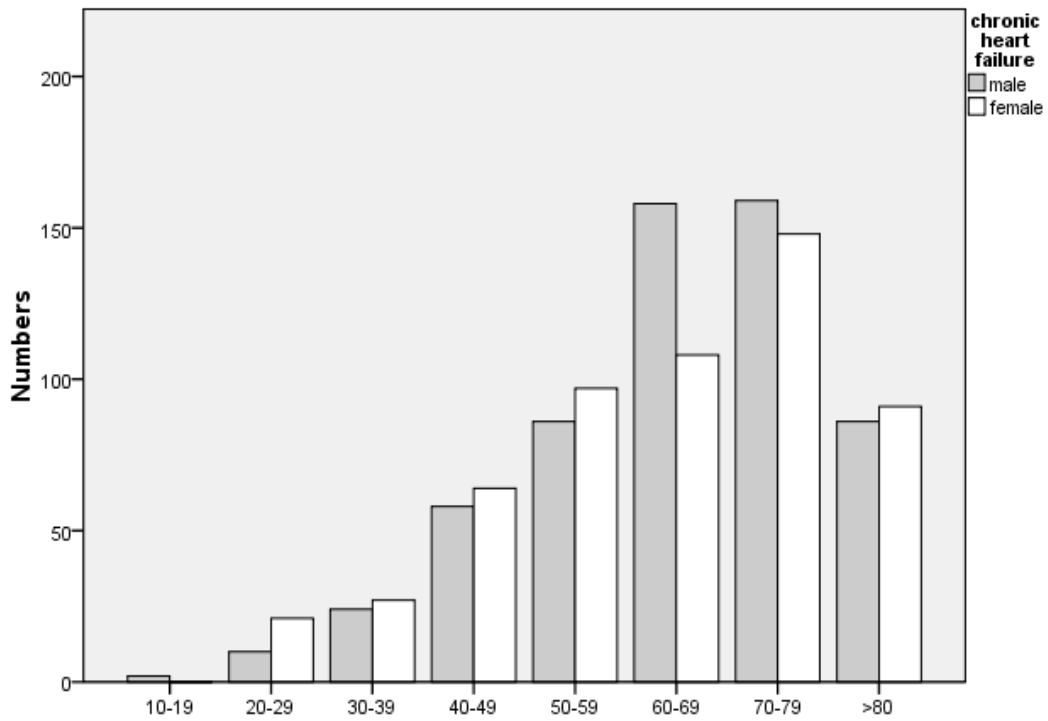

Fig. 5. Shows congestive heart failure distribution within different age groups for both males and females
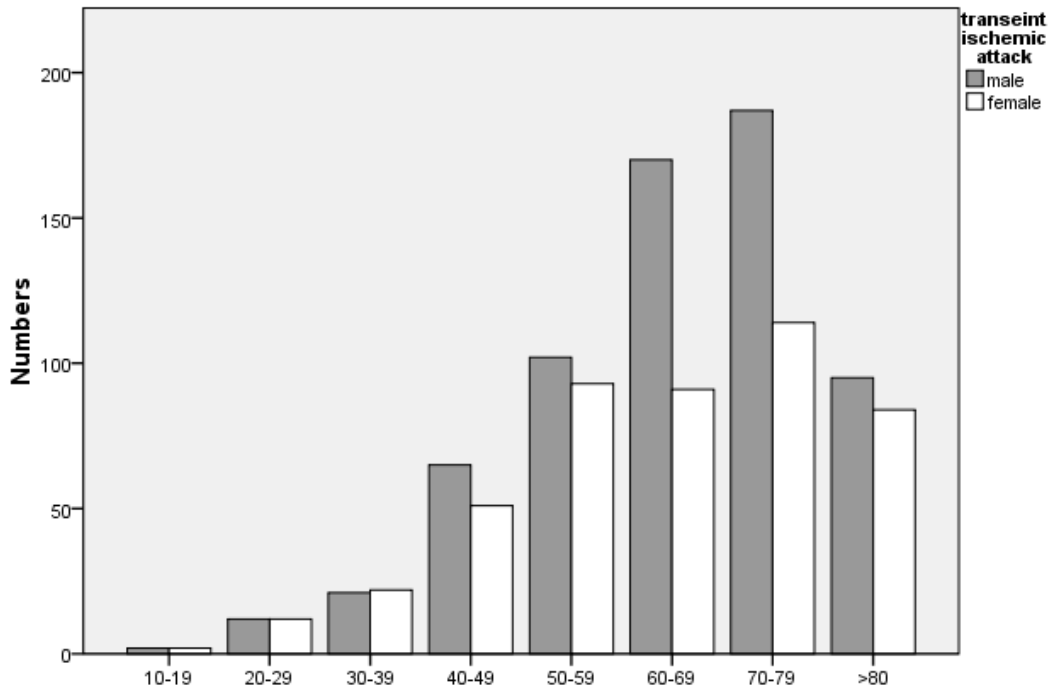
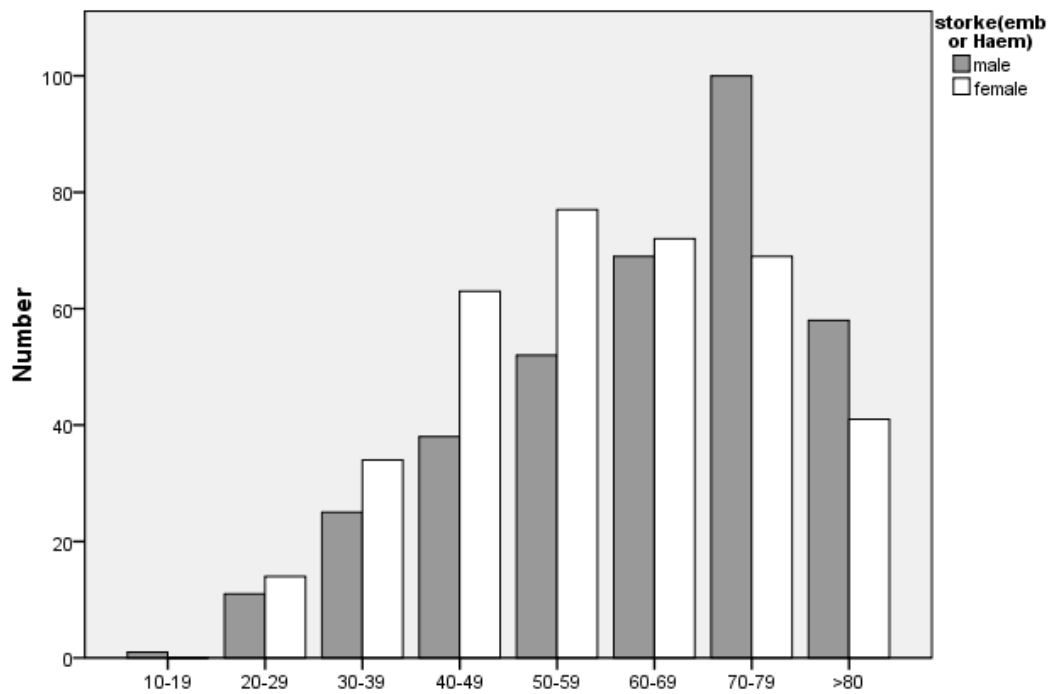**Fig. 6. Shows transient ischemic attack distribution among males, females and within different age groups**

Fig. 7. Shows prior stroke distribution within different age groups for both males and females

4. DISCUSSION

This is the first time such big study for assessing stroke risk factors among community population done in Libya; it found stroke is very common and important public health problem among Libyan citizen.

In the past, different studies done in Libya found high stroke prevalence rate [5]. Study in Benghazi (northeast of Libya) revealed, a stroke crude annual rate is 162 per 100.000 populations for those who are ≥ 45 years old [17]. This result is higher than the corresponding rates from some of developed countries [18].

In comparison to developing countries and results from this Libyan study, stroke prevalence rate in the USA is low, and the overall incidence of stroke in the young was 23 per 100 000 persons per year. However, like our Libyan study, stroke in USA is more frequent in males than females [19]. Conversely, the prevalence of stroke in Italy is high compared to other western countries and it is concordant with our high results [20].

Prevalence of diabetes mellitus in this study was 39%, which is unexpectedly higher than the rate found by Libyan research institute (7.9%) in 2001, and the rate found by CDC-WHO community survey (23.7%) in 2009 [13,14]. From these results, the prevalence is increased 15.8% in eight years (from 2001 to 2009), with increase by 2% each year, subsequently, we expect DM prevalence rate will be doubled during next years, especially if over whelming and distressing circumstances of Libya take into account.

According to the Libyan research institute, the hypertension prevalence rate among Libyan population in 2001 was 21.6% [13], and according to CDC-WHO survey in 2009 the rate increased to 40.6% [14]. In this Libyan study, the hypertension prevalence rate is high (38%) but is lower than the result from CDC-WHO survey.

Hypertension was the most frequent risk factor in stroke patients from Arab countries, being present in 24.9% to 67% of reported patients, while DM was present in 11.6% to 69.4% [6]. Our study also found that DM and hypertension are the most frequent risks of stroke.

This study found CHF prevalence rate as stroke contributing risk factor is high (15.2%); similar result found by other Libyan and Arab countries studies where found increasing rate of obesity, smoking, lack of exercise and eating of unhealthy diet among Libyan, and all of them are risk factors of cardiac disease [6,14].

Hypertension, ischemic heart disease, diabetes mellitus, smoking and hypercholesterolemia are well-known risk factors for stroke. Oxfordshire community stroke project study showed that risk factors for cerebral infarction were present in 80% of cases, hypertension in 52%, ischemic heart disease in 38%, peripheral vascular disease in 25%; cardiac lesions were a major potential source of emboli to the brain in 20% and diabetes mellitus in 10% [21]. Similar to other studies done in Arab countries [6]; Mortel et al. [22] reported that diabetes is second to hypertension as a risk factor for stroke, followed by heart disease and smoking. Likewise, this present study revealed DM & hypertension are heading risk factors Followed by CHF.

This study pointed that TIA are cardiovascular risk factors nevertheless, Prior TIA was associated with a favorable outcome in nonlacunar ischemic stroke, suggesting a neuroprotective effect of TIA possibly by inducing a phenomenon of ischemic tolerance allowing better recovery from a subsequent ischemic stroke [23]. This study found combined prevalence of 24.7% for TIA and prior stroke (embolic or hemorrhagic stroke) (15% & 9.7% respectively); other Libyan study found combined prevalence of 57% in 2009 which studied multiple risk factors of stroke [14].

Several articles reported stroke incidence rate in Arab countries like; Kuwait, Saudi Arabia, Qatar, Libya and Bahrain [6]. The incidence varied from the lowest of 27.5 per 100,000 populations per year in Kuwait to highest of 63 per 100,000 populations in Libya. Stroke rate increases with increase of age (affecting old people), males were more affected than females, and the most frequent stroke type is ischemic stroke. Hypertension was the most frequent risk factor, followed with DM, hyperlipidemia, cardiac diseases and cigarettes smoking [6]. This study found similar results (regarding Libya), this could be due to similarities between Arab population in their lifestyle and diet even though they are from different countries, and this similarities may

influence stroke risks, types and the survival after stroke [5,6].

In 10 year report of Saudi Arabia, the incidence and prevalence rate of stroke were low in comparison to those reported from Western countries, but this was mainly due to age structure of Saudi population (young people constitute the majority of population) [24]. However, in this Libyan study, stroke more common on older population (especially for age over 40) even though majority of Libyan population are young like Saudi population.

This study and other reports from Libya found stroke risk factors present among Libyan population and they are in state of increasing [13,14]. Stress is a major risk factor associated with increasing of all risk factors of stroke (with no true studies done in Libya), We thought that all the high prevalence of risk factors of stroke (DM, HT, CHF) and stroke prevalence itself, could be related to many complex factors but stress plays a major roll specially the severe stress and trauma related to civil war started in 2011 in Libya.

5. CONCLUSION

This study found stroke is a major important public health problem in Libya. Stroke prevalence rate increase with increase of age, and males affected more than females. DM, HT and CHF and previous history of stroke or transient ischemic attack are major risk factors associated with stroke. Moreover, stroke risk factors are increasing by time, and doubling of stroke prevalence rate in recent years might be related to sedentary life, obesity, bad eating habits, lack of exercise, epidemic of smoking, and sever stress from multiple civil wars inside the country.

6. STRENGTHS & LIMITATIONS OF THE STUDY

It is the first Libyan community based study that use CHADS2 questionnaire to assess stroke risk factors among those who do not have atrial fibrillation, although AF is an important cerebrovascular risk factor and its presence is associated with a higher hospital mortality, not just in ischemic stroke patients population as a whole, but also in cardioembolic stroke subtype patients [25].

Moreover, it uses large sample size, thus, the prevalence rates produced from this study reflect the real situation in the Libyan community. Finally, because, this study is cross-sectional study; therefore it explores associations, not causation.

7. RECOMMENDATIONS

To do another studies to measures stroke risk factors by using laboratory investigations, and other medical diagnostic procedures, consequently, to estimate the most accurate and true rates.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Feigin VL. Stroke epidemiology in the developing world. Lancet. 2005;365 (9478):2160–1.
2. Connor MD, Walker R, Modi G, et al. Burden of stroke in black populations in sub-Saharan Africa. Lancet. 2007;6(3): 269-278.
3. WHO. Burden of Disease Statistics. Geneva, Switzerland: World Health Organization; 2009.
   Available: who.int/healthinfo
4. Marrugat J, Arboix A, García-Eroles L, Salas T, Vila J, Castell C, Tresserras R, Elosua R. The estimated incidence and case fatality rate of ischemic and hemorrhagic cerebrovascular disease in 2002 in Catalonia. Rev Esp Cardiol. 2007; 60(6):573-80.
5. Tran J, Mirzaei M, Anderson L, et al. The epidemiology of stroke in the middle east and north Africa. J Neurol Sci. 2010;(jns-11401):1-3.
6. Benamer HT, Grosset D. Stroke in Arab countries: A systematic literature review. J Neurol Sci. 2009;(jns-10981):1-6.
7. WHO. Non-communicable diseases

country profiles: Libya; 2014.
Available: who.int/nmh/countries

8. National Institute of Neurological Disorders and Stroke. Stroke: hope through research. National Institutes of Health. 2004;99(2222).

9. Suk SH, Sacco RL, Boden-Albala B, et al. Abdominal obesity and risk of ischemic stroke, The Northern Manhattan Stroke Study. American Heart Association. 2003; 34:1586-1592.

10. Donnan GA, Fisher M, Macleod M, et al. "Stroke". Lancet. 2008;371(9624):1612–23.

11. Whisnant JP. Effectiveness versus efficacy of treatment of hypertension for stroke prevention. Neurology. 1996;46(2):301–7.

12. Dormandy JA, Charbonnel B, Eckland DJ, et al. Secondary prevention of macrovascular events in patients with type 2 diabetes in the proactive Study: a randomized controlled trial. Lancet. 2005; 366(9493):1279–89.

13. Bony AM, Sasi AA, Bacuch MM, et al. Risk factors of hypertension in Libya. Libyan National Research Institute. 2001;1-32.

14. Tamer HE, Al-Shref EA, Imsalem OR, et al. Survey of risk factors of non-communicable diseases in Libya. Ministry of Health Report (CDC-WHO). 2009;1-48.

15. Gage BF, Waterman AD, Shannon W, et al. Validation of clinical classification schemes for predicting stroke. JAMA. 2001;285:22.

16. Morillas P, Pallarés V, Fácila L, Llisterri JL, et al. The CHADS2 score to predict stroke risk in the absence of atrial fibrillation in hypertensive patients aged 65 years or older. Rev Esp Cardiol (Engl Ed). 2014; 2:1-7.

17. Said E, Mukhtyar A, Prakash P. Stroke: Incidence and pattern in Benghazi, Libya. Annals of Saudi Medicine. 1995;15(4): 367-369.

18. Bonita R, Beaglehole R, North JD. Event, incidence and case fatality rates of cerebrovascular disease in Auckland, New Zealand. Am J Epidemiol. 1984;120:236-43.

19. Bradley S, Boden-Albala B, Lin I, et al. Sacco stroke in the young in the Northern Manhattan, stroke, american stroke Association, Published Online. 2002;1-5.

20. Teso V, Caroli A, Gensini G. Stroke in Italy and related impact on outcome (SIRIO) study: Design and baseline data. Neurol Sci. 2006;27:263–267.

21. Sandercock PA, Warlow CP, Jones LN, et al. Predisposing factors for cerebral infarction: The oxfordshire community stroke project. BMJ. 1989;298:75-80.

22. Mortel KF, Meyer JS, Sim PA, et al. Diabetes mellitus as a risk factor for stroke. South Med J. 1990;83:904-11.

23. Arboix A, Cabeza N, García-Eroles L, Massons J, Oliveres M, Targa C, Balcells M. Relevance of transient ischemic attack to early neurological recovery after nonlacunar ischemic stroke. Cerebrovasc Dis. 2004;18(4):304-11.

24. Rajeh S. Stroke in Saudi Arabia. Cerebovascular diseases. 2002;13:3-8.

25. Arboix A, García-Eroles L, Massons JB, Oliveres M, Pujades R, Targa C. Atrial fibrillation and stroke: Clinical presentation of cardioembolic versus atherothrombotic infarction. Int J Cardiol. 2000;73(1):33-42.

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